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Volume XXXVII Number 5

OCT 16 1929

The Journal of Political Economy

PUBLISHED BY THE UNIVERSITY OF CHICAGO

OCTOBER 1929

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THE UNIVERSITY OF CHICAGO PRESS
CHICAGO, ILLINOIS, U.S.A.

October 1929 Volume XXXVII, No. 5

THE JOURNAL OF POLITICAL ECONOMY

EDITED BY JACOB VINER AND F. H. KNIGHT, WITH THE CO-OPERATION OF THE OTHER MEMBERS OF THE DEPARTMENT OF ECONOMICS OF THE UNIVERSITY OF CHICAGO

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The Journal of Political Economy is published bi-monthly, by the University of Chicago at the University of Chicago Press, 5750 Ellis Avenue, Chicago, Illinois. The subscription price is $4.00 per year; the price of single copies is 75 cents. Orders for service of less than a half-year will be charged at the single-copy rate. ¶ Postage is prepaid by the publishers on all orders from the United States, Mexico, Cuba, Porto Rico, Panama Canal Zone, Republic of Panama, Dominican Republic, Canary Islands, El Salvador, Argentina, Bolivia, Brazil, Colombia, Chile, Costa Rica, Ecuador, Guatemala, Honduras, Nicaragua, Peru, Haiti, Uruguay, Paraguay, Hawaiian Islands, Philippine Islands, Guam, Samoan Islands, Balearic Islands, Spain, and Venezuela. ¶ Postage is charged extra as follows: for Canada, and Newfoundland, 25 cents on annual subscriptions (total $4.25); on single copies 4 cents (total 79 cents); for all other countries in the Postal Union, 35 cents on annual subscriptions (total $4.35), on single copies 6 cents (total 81 cents). ¶ Patrons are requested to make all remittances payable to the University of Chicago Press in postal or express money orders or bank drafts.

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For the British Empire, except North America, India, and Australasia: The Cambridge University Press, Fetter Lane, London, E.C. 4, England. Yearly subscriptions, including postage, £1 2s. each; single copies, including postage, 4s. each.

For Japan: The Maruzen Company, Limited, Tokyo.

For China: The Commercial Press, Ltd., Paoshan Road, Shanghai. Yearly subscriptions, $4.00; single copies, 75 cents, or their equivalents in Chinese money. Postage, extra on yearly subscriptions 35 cents, on single copies 6 cents.

Claims for missing numbers should be made within the month following the regular month of publication. The publishers expect to supply missing numbers free only when losses have been sustained in transit and when the reserve stock will permit.

Business Correspondence should be addressed to The University of Chicago Press, Chicago, Ill.

Communications for the editors and manuscripts should be addressed to the Editors of THE JOURNAL OF POLITICAL ECONOMY, The University of Chicago, Chicago, Ill.

The articles in this Journal are indexed in the Reader's Guide to Periodical Literature, New York, New York.

Entered as second-class matter January 16, 1893, at the Post-office at Chicago, Illinois, under the Act of March 3, 1879.
Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 15, 1918.

PRINTED IN THE U.S.A.

THE JOURNAL OF
POLITICAL ECONOMY

Volume 37 OCTOBER 1929 *Number 5*

MARGINAL PRODUCTIVITY AND THE GENERAL PRICING PROCESS[1]

I. INTRODUCTION

IT IS the object of this paper (1) to deduce the theorems of the marginal-productivity theory in such a way as to lay bare their underlying assumptions; (2) to show the relation of marginal productivity to the general pricing process; (3) to suggest a statement of the relation between cost and price which appears to be more satisfactory than the current theory; and

[1] While conducting this investigation I have received advice and criticism from several persons.

Professor Walter Bartky, of the Department of Astronomy, read the manuscript and kindly and freely gave mathematical advice and criticisms, which have been of the greatest service. Mr. A. Oppenheim, of England, Commonwealth Fund Research in Mathematics, has rendered a similar service. Without the assistance of these mathematicians, I could not have given the proof discussed in Appendix I B, pp. 543–44.

Professor Étienne Antonelli, of the University of Lyon, a former student of Walras', and Professor Pascal Boninsegni, of the University of Lausanne, who succeeded Pareto to the Chair of Political Economy in that University, have rendered invaluable assistance by having freely and fully answered various questions on the history of the marginal-productivity theory. To Professor Antonelli I owe special thanks for permission to publish Walras' letter to Barone.

Miss Ramona Simpson checked the mathematics and assisted in the preparation of the manuscript for the printer.

(4) to consider some aspects of the problem of the statistical measurement of the productivities of labor and capital which have not as yet been noticed.

Although the concept of marginal productivity is quite old and has been treated by many writers, no attempt will be made to trace its historical development. Attention will be centered principally on the contributions of three economists—Léon Walras, Enrico Barone, and Vilfredo Pareto—for the reason that these economists were the first to give the theory its rational, mathematical formulation and to connect it with the general theory of economic equilibrium, and for the further reason that Pareto has also given the best criticism of the theory available. Advantage will be taken of this opportunity to call attention to at least one mathematical error in Walras' treatment of the theory, and to present a corrected and unified statement of the whole subject.

II. THE COST EQUATIONS WITH FIXED COEFFICIENTS OF PRODUCTION

It is convenient to begin with the fundamental cost equations of mathematical economics which were introduced into economic theory by Léon Walras in 1876.

Walras formulates these equations by means of the following symbols:

Let the commodities produced in a unit of time be m in number, and let them be represented by (A), (B), (C), (D). . . .

The factors of production fall into three classes: services of land *(terre)*, (T), (T'), (T''), . . . ; services of persons, (P), (P'), (P''), . . . ; services of capital, (K), (K'), (K''), ... Let the total number of these services, for the unit of time, be n.

Let the commodity (A) be taken as a *numéraire* in terms of which the prices of the commodities and services are expressed, so that the price of (A) is $p_a=1$. The respective prices of the other commodities may then be represented as p_b, p_c, p_d, . . . and the respective prices of the services as p_t . . . , p_ρ . . . , p_π . . . .

Let

$$a_t, a_p, a_k, \ldots$$
$$b_t, b_p, b_k, \ldots$$
$$c_t, c_p, c_k, \ldots$$

be the coefficients of production *(coéfficients de fabrication)*, or the respective quantities of each of the productive services (T), (P), (K), . . . that enter into the manufacture of a unit of the products (A), (B), (C), (D), ... (Thus, b_p stands for the quantity [number of units] of the service (P) that enters into the manufacture of one unit of the commodity (B).)

The cost equations then become:

$$\left.\begin{aligned} a_t p_t + \cdots + a_p p_p + \cdots + a_k p_k + \cdots &= 1 \\ b_t p_t + \cdots + b_p p_p + \cdots + b_k p_k + \cdots &= p_b \\ c_t p_t + \cdots + c_p p_p + \cdots + c_k p_k + \cdots &= p_c \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots & \end{aligned}\right\}. \qquad [1]$$

There are m of these equations, since there are m commodities. They express only *one* of the conditions of general static equilibrium: that the (unit) costs of production of the commodities must be equal to their prices. Together with the nine other conditions,[2] or sets of equations they constitute the Walrasian solution of the problem of general equilibrium, because they comprise a number of equations equal to the number of unknowns.

In any interpretation of equations [1] it is necessary to keep in mind the fact that Walras assumes the coefficients of production to be constant in the static state. They are among the known, and not among the unknown, elements of his system.

In making this assumption, Walras neglects another circumstance: the distinction between the fixed and the variable costs of the firms *(entreprises)*. His justification is: "Since we are assuming that entrepreneurs neither gain nor lose, we may well assume that they are also manufacturing equal quantities of the products, in which case costs of all kinds may be considered as proportional."[3]

[2] Léon Walras, *Éléments d'économie politique pure* (4th ed., 1900), pp. 254–60 and 297–308.

[3] *Ibid.*, p. 213.

That the coefficients of production are constant or determined *a priori* remained an essential assumption of the Walrasian system from the time that it was promulgated until the middle nineties, when Barone and Walras, and (with greater skill and accuracy) Pareto, succeeded in introducing variable coefficients of production into the equations of general equilibrium and in showing how to determine their values together with the other unknowns of the system. This gave rise to the mathematical theory of marginal productivity, which was corrected, completed, and surpassed by Pareto's theory of production.[4] The specific problems on which these economists sought to throw light are: How are the coefficients of production and their prices determined? According to what principle are the services of the factors of production distributed among the various industries?

III. VARIABLE COEFFICIENTS OF PRODUCTION AND MARGINAL PRODUCTIVITY[5]

Take any commodity—say, (B)—into the manufacture of which there enter respectively $b_1, \ldots b_p, \ldots b_k \ldots$ units of

[4] See Léon Walras, *op. cit.* (4th ed., 1900), p. 376; *ibid.* (1926), p. 376 n.; Vilfredo Pareto, *Cours d'économie politique*, Vol. II (1897), paragraphs 714–31; and letter from Walras to Barone in Appendix II of this paper (pp. 547–49).

The theory of marginal productivity was broached at about the same time by several other economists, American, English, and Italian. But of these, only Barone and Walras and (especially) Pareto succeeded in developing a rational, mathematical theory and in relating it to the general pricing process.

Barone and Walras developed their solution in 1894 and 1895. Walras included it in his "Note sur la réfutation de la théorie anglaise de fermage de M. Wicksteed," which was published in 1896, and reprinted this "note" in the third edition of his *Eléments*, which was published in the same year. In the 1900 and the 1926 edition of the *Éléments*, Walras devotes the thirty-sixth "lesson" to it.

Barone communicated his results to Walras in 1894 and 1895. In 1896 he published two parts of an unfinished paper on marginal productivity in the *Giornale degli Economisti* (February and March). But this paper contains no reference to equation [3], to the property of function [7], or to the related theorems discussed in section III.

The explanation is (letter from Professor Pascal Boninsegni) that Pareto informed him of the error which he was making and Barone interrupted the publication of his study.

[5] Though the symbols used in this section are substantially the same as in the thirty-sixth "lesson" of the 1900 edition of Walras' *Éléments*, the treatment

the services $(T), \ldots (P), \ldots (K), \ldots$ for every unit produced. Its cost of production is by [1],

$$b_t p_t + \cdots + b_p p_p + \cdots + b_k p_k + \cdots = p_b . \qquad [2]$$

In any concrete situation it is probable that some of these coefficients of production are constant or nearly so, that others vary with the quantity of the commodity produced, and that still others exhibit a special kind of variation: they form a group such that a decrease in some of them may be compensated by an increase in the others.

In other words, we shall probably find in any concrete investigation that some services are required in fixed amounts per unit of product: as the amount of gold necessary for making one gold eagle ($10), or the amount of clay necessary for making a pot of given dimensions; that other services are required in varying amounts per unit of output, depending only on the scale of production: as the amounts of the various overhead items per unit of output; and that still other services are not required according to any such predetermined physical law. They form a group such that if the amount per unit of product of any one of them is decreased, this may be compensated by an increase in the others (Marshall's variable proportions). Thus we may obtain the same milk yield from a cow by feeding it less corn and more hay, or vice versa. Also, we may get the same amount of work by using either electric power, steam power, or human labor, or all of them. The particular combination selected will depend on the prices of the services.

Let us assume that *all* of the coefficients of production which enter into the manufacture of a unit of the commodity under consideration (B) are of the third kind. The technical conditions of production, it is assumed, will give us the law of their compensations, which may be expressed in symbolic form as follows:

$$\phi_b(b_t, \ldots b_p, \ldots b_k, \ldots) = 0 . \qquad [3]$$

---

is quite different. I have attempted to correct the errors into which Walras appears to have fallen (see Appendix II, pp. 545–51), to lay bare the underlying assumptions of the theory, and to present the mathematical developments in sufficient detail to enable the reader to follow the argument without much difficulty.

The economic problem is to determine the coefficients of production at the same time as their prices and all other unknowns of the general equilibrium.

Under free competition, which is assumed herein, the solution may be obtained by positing that each entrepreneur tries to minimize his cost of production for a given output, or—what in this problem amounts to the same thing—to maximize his output for a given total cost. The procedure is as follows:

By the Walrasian definition of a coefficient of production,

$$b_t=\frac{T}{Q_b}, \ldots b_p=\frac{P}{Q_b}, \ldots b_k=\frac{K}{Q_b}, \ldots . \qquad [4]$$

where Q_b is the output of the commodity (B), and $T, \ldots P, \ldots K, \ldots$ are respectively the total quantities of the productive services used in the production of Q_b.

If the expression "input per unit of output," which has recently been introduced by a group of agricultural economists, were confined to physical units only, it would be identical with the definition of a coefficient of production as given by [4].[6]

Substituting these values of the coefficients of production in [2], and clearing fractions, we have

$$Q_b p_b = Tp_t + \cdots + Pp_p + \cdots + Kp_k + \cdots , \qquad [5]$$

which simply states that, under equilibrium conditions, total receipts from the sale of Q_b must be equal to the total cost of production of Q_b.

Also, substituting these values of the coefficients of production in [3], we obtain

$$\phi_b\left(\frac{T}{Q_b}, \ldots \frac{P}{Q_b}, \ldots \frac{K}{Q_b}, \ldots\right)=0 . \qquad [6]$$

[6] See H. R. Tolley, J. D. Black, and M. J. B. Ezekiel, "Input as Related to Output in Farm Organization and Cost-of-Production Studies," *U.S. Dept. Agr. Bull. No. 1277* (1924); and J. D. Black, *Production Economics* (1926), pp. 275–380. Some of the graphs in the latter publication are wrongly labeled. Apparently these economists were not acquainted with the theory which employs "coefficients of production," but their term "input per unit of output" is to be commended (provided it is confined to physical relations) for its mnemonic properties.

If, in [3] ≡ [6], Q_b does not figure in an explicit manner[7]—that is, if the coefficients of production do not *explicitly* depend on the output Q_b—we have by the fundamental existence theorem for implicit functions[8]

$$Q_b = F_b(T, \ldots P, \ldots K, \ldots), \qquad [7]$$

and since Q_b does not enter explicitly in [6], it can be shown that [7] defines a homogeneous equation of the first degree in $T, \ldots P, \ldots K, \ldots$. (For proof see Appendix I, pp. 542–45.)

An important property of such a function is that

$$Q_b = \frac{\partial F_b}{\partial T} T + \cdots + \frac{\partial F_b}{\partial P} P + \cdots + \frac{\partial F_b}{\partial K} K + \cdots, \qquad [8]$$

which is a special case of Euler's theorem on homogeneous functions (see Appendix I, p. 542.)

But the partial derivatives

$$\frac{\partial F_b}{\partial T}, \cdots \frac{\partial F_b}{\partial P}, \cdots \frac{\partial F_b}{\partial K} \cdots$$

[7] A simple example of a function fulfilling this condition is

$$\phi_b(b_1, b_k) \equiv A b_1^{\alpha} b_k^{\beta} - 1 \equiv A \left(\frac{T}{Q_b}\right)^{\alpha} \left(\frac{K}{Q_b}\right)^{\beta} - 1 = 0, \qquad [i]$$

where A, α, and β are constants. From this equation we can deduce

$$Q_b = (A T^{\alpha} K^{\beta})^{1/(\alpha+\beta)}, \qquad [ii]$$

which is a homogeneous function of the first degree in T and K. (See Appendix I, pp. 542–43.) This corresponds to equation [7] of the text.

Consider next the function

$$\phi(b_1, b_k) \equiv A \left(\frac{T}{Q_b}\right)^{\alpha} \left(\frac{K}{Q_b}\right)^{\beta} + B Q_b - 1 = 0, \qquad [iii]$$

where B is a constant. It is the same as [i] except for the middle term. Here Q_b *enters in an explicit manner* and the equation

$$Q_b = \left(\frac{A T^{\alpha} K^{\beta}}{1 - B Q_b}\right)^{1/(\alpha+\beta)}, \qquad [iv]$$

deduced from [iii], is therefore not a homogeneous function of the first degree in T and K.

[8] See Goursat-Hedrick, *Mathematical Analysis*, Vol. I, chap. ii, §20; William F. Osgood, *Advanced Calculus*, chap. v, §12; or Edwin B. Wilson, *Advanced Calculus*, chap. v, §56.

are the marginal degrees of productivity of the factors $T, \ldots P, \ldots K, \ldots$. The economic interpretation of equation [8] is, therefore, that the total quantity of the commodity produced is equal to the sum of the products of the productive services by their marginal productivities; or, more briefly, that the total production of the commodity is distributed among the productive services. It still remains to be proved that the services are paid according to their marginal productivities.

The entrepreneur tries to maximize his output [7] for a given total cost [5]. Using the method of multipliers,[9] we may state this condition in symbolic form as follows:

$$F_b(T, \ldots P, \ldots K, \ldots) + \lambda(Q_b p_b - Tp_t - \ldots - Pp_p - \ldots - Kp_k - \ldots) = Maximum, \qquad [9]$$

where λ is a constant multiplier, and $(Q_b p_b)$ is also treated as constant.

The necessary conditions for a maximum (or minimum) are obtained by equating to zero each of the partial derivatives of [9]. Since we are assuming free competition, we are saying in effect that each entrepreneur considers the market prices of the services as unaffected by his purchases. This does not mean, however, that the resultant of the actions of the individual producers will have no effect on the prices of the productive services. All it means is that in differentiating [9], $p_t, \ldots p_p, \ldots p_k, \ldots$ must each be considered as constant. We have:

$$\left.\begin{array}{lll} \dfrac{\partial F_b}{\partial T} - \lambda p_t = 0 & \text{or} & \dfrac{\partial F_b}{\partial T} = \lambda p_t \\ \ldots\ldots & & \ldots\ldots \\ \dfrac{\partial F_b}{\partial P} - \lambda p_p = 0 & \text{or} & \dfrac{\partial F_b}{\partial P} = \lambda p_p \\ \ldots\ldots & & \ldots\ldots \\ \dfrac{\partial F_b}{\partial K} - \lambda p_k = 0 & \text{or} & \dfrac{\partial F_b}{\partial K} = \lambda p_k \\ \ldots\ldots & & \ldots\ldots \end{array}\right\}. \qquad [10]$$

[9] See Goursat-Hedrick, *op. cit.*, Vol. I, chap. iii, §61.

Equations [10] give the condition for a maximum output or minimum cost of Q_b, which is that the marginal productivity of each service should be proportional to its price. This condition corresponds to that for maximizing utility in the theory of demand, which is that the price of the commodity should be proportional to its marginal utility.

But to say that the marginal productivity of each service should be proportional to its price is not definite enough. We must find the "factor of proportionality," λ. To do this we multiply the first equation of [10] by T, the second by P, etc., and add. The result is

$$\frac{\partial F_b}{\partial T}T+\cdots+\frac{\partial F_b}{\partial P}P+\cdots+\frac{\partial F_b}{\partial K}K+\cdots=\lambda\,(Tp_t+\cdots+Pp_p+\cdots+Kp_k+\cdots).$$

But since F_b is a homogeneous function of the first degree, the left-hand side of the foregoing equation is equal to Q_b, by Euler's theorem on homogeneous functions, and the right-hand side is equal to $\lambda(Q_bp_b)$, by [5], giving

$$Q_b=\lambda\,(Q_bp_b),$$

or

$$\lambda=\frac{1}{p_b}. \qquad [11]$$

Substituting this value for λ in [10], we obtain

$$\frac{\partial F_b}{\partial T}=\frac{p_t}{p_b},\ \cdots\ \frac{\partial F_b}{\partial P}=\frac{p_p}{p_b},\ \cdots\ \frac{\partial F_b}{\partial K}=\frac{p_k}{p_b},\ \cdots. \qquad [12]$$

We have now a second statement of the condition of maximum output or minimum cost: The marginal degree of productivity of each service should be equal to the ratio of the price per unit of the service to the price per unit of the commodity.

From this it follows that

$$\Delta T\frac{\partial F_b}{\partial T}p_b=\Delta Tp_t,\ \cdots\ \Delta P\frac{\partial F_b}{\partial P}p_b=\Delta Pp_p,\ \cdots\ \Delta K\frac{\partial F_b}{\partial K}p_b=\Delta Kp_k,\ \cdots. \qquad [13]$$

This is our final restatement of the condition of minimum cost, which is also one of the conditions of stable equilibrium: Production should be carried to a point where the value of the product imputed to the final increment of each service is just equal to the price increment of the service. When production is carried to this point, equations [8] and [13] tell us that the earnings of the several productive services according to their marginal productivities exhaust the total production of the commodity.

By an identical procedure, equations like the foregoing can be deduced for all the other commodities (A), (C), (D), ... They are equal in number to the number of new unknowns introduced. *They must be solved simultaneously with all the other equations of equilibrium.* It is impossible to abstract the other circumstances of economic equilibrium and determine the prices of the productive services from a consideration of their marginal productivities even if the underlying assumptions of the marginal productivity theory were valid. The marginal productivities of the services are not a *cause* which determines the prices of the factors and the cost of production of the commodity. They simply form one set of conditions, which, *when taken in conjunction with all the other conditions of economic equilibrium,* determine the unknowns of the problem.

Equations [3], [5], [7], [8], and [12] constitute the theory of marginal productivity. In 1900, Walras summarized it in three propositions, as follows:

> 1. *Free competition brings the cost of production down to a minimum;*
>
> 2. *Under this régime, the rate of remuneration of each service is equal to the partial derivative of the production function, or to its marginal productivity;*
>
> 3. *The whole quantity of the manufactured product is distributed among the productive services.*
>
> This triple proposition constitutes the *theory of marginal productivity,* a capital theory in pure economics, because it introduces into the problem of production the system of equations (3) [equations [12] of this paper] in number equal to that of the coefficients of production and in which the coefficients figure as unknowns, and because it thus furnishes the relation between the demand for the services and the supply of the products by the

entrepreneurs, just as the *theory of final utility* furnishes the relation between the demand for the products and the supply of the services by landlords, workers, capitalists....[10]

Walras went on to say that

This theory of marginal productivity, the germ of which is to be found in Chapters VI and VII of Jevons' *Theory of Political Economy*, has been broached by several American and Italian economists, especially by Wood, Hobson, Clark, and Montemartini. But it remained empirical until Pareto and Barone connected it with the production equation (325) [equation [3] of this paper] ....[11]

Regarding these statements the following remarks are in order:

1. The first proposition is essentially a condition of solution, or a definition, and not a deduction.

2. The second and third propositions are true only if the equation

$$Q_b = F_b(T, \ldots P, \ldots K, \ldots) \qquad [7]$$

is a homogeneous function of the first degree in $T, \ldots P, \ldots K, \ldots$, and this is true only if *all* the coefficients of production are compensatory, i.e., if they are all connected by a function

$$\phi_b(b_t, \ldots b_p, \ldots b_k, \ldots) = 0, \qquad [3]$$

and if Q_b does not enter explicitly in [3]. Walras makes no explicit mention of these conditions.

3. In deducing these propositions, Walras appears to have made at least one mathematical error, which is troublesome to the student, and which appears to have been overlooked by his critics. Furthermore, he does not clearly indicate the underlying assumptions of the theory; and he argues that to assume variable coefficients of production is to pass from statics to dynamics. (See Appendix II, pp. 545–51.)

4. Walras might have done more justice to the contributions to the marginal-productivity theory of the non-mathematical economists, and especially those of Clark and Carver. In this connection an opinion which Edgeworth expressed on some of

[10] Léon Walras, *Éléments d'économie politique* (4th ed., 1900), pp. 375–76.

[11] *Ibid.*, p. 376.

the early writers on probability is quite appropriate: "Nevertheless here, as so often in mathematics, genius may have flown to a point whither method afterwards constructs a road."[12]

In 1902 Walras made several changes in his theory, which, however, were not incorporated in his *Éléments* until 1926, when there was published a reprint of the fourth (1900) edition of this work, "revue et augmentée par l'auteur."[13] Without apprising the reader, he suppressed the last of the three propositions quoted above, and equation [8], of which it is a verbal translation; and changed the second proposition to read that in a state of equilibrium the prices of the services are proportional to their marginal productivities. He also omitted the statement that the theory of marginal productivity "remained empirical until Pareto and Barone connected it with the production equation. . . ."

In a footnote Walras explains why he felt compelled to assume sole responsibility for the theory: He could not agree with Pareto when the latter declared in November 1901 (*L'économie pure*, p. 10) the marginal-productivity theory to be "erroneous," and Walras' equation (3) [equations [12] of this paper] to be "inadmissible" because "on y traite comme des variables indépendantes des quantités qui ne le sont pas"; and Pareto apparently succeeded in converting Barone to his viewpoint.

For a discussion of this question and related subjects the reader must be referred to Appendix II, pp. 545–51. Here we must content ourselves with the following observations:

Walras' treatment of the marginal-productivity theory may be criticized on two grounds which, while not independent, are nevertheless sufficiently distinct to require separate mention: (1) that his fundamental assumptions, explicit or implied, are not in agreement with the economic facts, and (2) that even on the basis of these assumptions his treatment contains at least one mathematical error.

Pareto's reference to Walras' treatment of dependent variables as though they were independent variables is a criticism of

[12] F. Y. Edgeworth, "Observations and Statistics," *Trans. Camb. Philos. Soc.*, XIV (1885), 149.

[13] I must thank Mr. Donald Weaver for calling my attention to the change which Walras made in the 1926 edition.

the first kind. It is a translation, in mathematical terms, of his fundamental *economic* objections to the marginal-productivity theory. The questions which he raises are: Are the fundamental assumptions of the theory valid or reasonable? If not, is there another theory which is more in agreement with the facts? We now turn to an examination of these questions.

IV. PARETO'S CRITICISM OF THE MARGINAL-PRODUCTIVITY THEORY

Pareto's fundamental criticism of the marginal-productivity theory relates primarily to the assumptions which must be made in order to obtain a production function which is homogeneous and of the first degree. It is so well put that no apology is necessary for quoting it at some length.

> Some authors assume that if *all* the factors of production are doubled the product will also double. This may be true approximately, in a certain case, but not rigorously and in general. Some expenses vary with the importance of the business *(entreprise)*. It is certain that if we could assume another business under conditions exactly resembling those of the first, we might double all the factors and the product. But this assumption is not, in general, admissible. If, for example, one were engaged in the transportation business in Paris, it would be necessary to assume another business and another Paris. But, as this other Paris does not exist, we must consider two businesses in the same Paris, and then, we cannot assume that, when the quantities of the factors of production are doubled, the product will also double.
>
> We must observe that if one cannot assume that all the coefficients of production are constant, neither can we assume that they are all variable. From a certain quantity of iron ore, for example, it is impossible to extract more metallic iron than is contained in this mineral. A certain state of technical knowledge being given, the quantity of metallic iron which may be obtained from a ton of a certain ore is a fixed quantity. In other words, the quantity of ore to be employed is proportional to the quantity of iron which we wish to produce.[14]

A general method of representing the relations among the coefficients of production pertaining to any one commodity is to assume that some of them are constant, others are related by one type of function, and still others by other types. It is only when *all* of the coefficients relating to the commodity in question are

[14] Vilfredo Pareto, *Cours d'économie politique*, Vol. II (1897), §714, pp. 82–83. See also Appendix II, pp. 549–51, of this study.

connected by *one* equation of type [3] and when the quantity of the commodity Q_b does not enter explicitly into it that equation [7] becomes a homogeneous function of the first degree and leads to the beautiful simplification of the pricing process by which we may prove that the product is divided among the factors of production proportionally to their marginal productivities (equation [8]), and that the price increment of the product is just equal to the price increment of the factor (equation [13]).

In Pareto's own words:

> To establish the conditions of economic equilibrium by making use of the notion of *marginal production*, one observes that the entrepreneur increases the quantity of one of the factors of production, as long as the expense which he thus incurs is less than the amount which he receives for the product obtained thereby. One thus reaches the same conditions which we have obtained...; but there is the inconvenience that, when some of the coefficients of production are constant, the consideration of marginal productivity cannot be applied without corrections. Concretely, if, for example, the quantity of iron ore must be proportional to the quantity of the metallic iron produced..., we cannot assume that by increasing a single one of the other factors of production the product will also be increased. For this effect to be realized the quantity of ore must necessarily increase also.
>
> But without mentioning similar cases, there are others where it is impossible to compensate an increase of one of the capitals through the diminution of the others. For example, to produce a certain quantity of silk goods we must have a certain floor space on which to spread out the fabric; but then even if we doubled this surface, without increasing the other capitals, we would never increase the product.
>
> *One must not therefore make use of the theory of marginal production without taking these corrections into account; and when these corrections are taken into account, one reaches the same results which we have obtained more quickly and more simply through the use of coefficients of production.* [Italics mine.][18]

V. SOLUTION PROVIDED BY THE GENERAL EQUILIBRIUM THEORY

It is not the purpose of this section to present a complete analysis of the place that cost occupies in Pareto's theory of general equilibrium. All that will be attempted is a summary of

[18] Vilfredo Pareto, *op. cit.*, §717, pp. 85–86.

some of the major conclusions of this theory relating to cost of production. Those who are desirous of pursuing this subject further may be directed to the *Manuel* and especially to its Mathematical Appendix.[16]

A. NEW DEFINITION OF A COEFFICIENT PRODUCTION

Instead of retaining his first concept of a coefficient of production which we find in the *Cours*, and which is also the Walrasian concept (see equation [4]), Pareto presents a new one in the *Manuel*.

Production is the transformation of certain goods and services into other goods and services.

Let $T, \ldots P, \ldots K, \ldots$ be respectively the total quantities of the services $(T), \ldots (P), \ldots (K), \ldots$ transformed.

Let $A, \ldots B, \ldots C, \ldots$ be respectively the quantities of the commodities $(A), \ldots (B), \ldots (C), \ldots$ produced. (Hitherto, the Walrasian $Q_a, Q_b, \ldots$ have been used for $A, B, \ldots$. See [4], p. 510. But it is not convenient to retain these symbols in the equations which follow.)

The technical conditions of production determine, within certain limits, the quantities $T, \ldots P, \ldots K, \ldots$ as functions of $A, \ldots B, \ldots C, \ldots$; or,

$$\left.\begin{aligned} T &= F(A, \ldots B, \ldots C, \ldots) \\ &\cdots\cdots\cdots\cdots \\ P &= G(A, \ldots B, \ldots C, \ldots) \\ &\cdots\cdots\cdots\cdots \\ K &= H(A, \ldots B, \ldots C, \ldots) \\ &\cdots\cdots\cdots\cdots \end{aligned}\right\}. \qquad [14]$$

[16] Of this Appendix Edgeworth wrote: "The mathematical appendix is a gem which—unlike the gold upon the statue of Athené on the Acropolis—cannot be separated from the object which it decorates" (article on Pareto in the latest [1926] edition of Palgrave's *Dictionary of Political Economy*). The theory of the *Manuel* (1909) differs considerably from that of the *Cours* (1896–97). A summary of Pareto's latest theory may be found in his article on "Économie mathématique" in the *Encyclopédie des Sciences Mathématiques*, Tome I, Vol. IV, fascicule 4, pp. 591–640. This was published in 1911.

Pareto then defines[17] the *coefficients of production* as the partial derivatives

$$\left.\begin{aligned} a_1 &= \frac{\partial F}{\partial A}, \; a_2 = \frac{\partial G}{\partial A}, \; a_k = \frac{\partial H}{\partial A} \\ b_1 &= \frac{\partial F}{\partial B}, \; b_2 = \frac{\partial G}{\partial B}, \; b_k = \frac{\partial H}{\partial B} \\ &\cdots\cdots\cdots \end{aligned}\right\}. \qquad [15]$$

In economic terms, the difference between the old and the new definitions of a coefficient of production—compare [4] with [15]—is that between an *average* and a *marginal* change. According to [4] a coefficient of production is measured by dividing the number of units of the productive service by the number of units of the commodity produced (average concept); according to [15], it is measured by finding the change in the service corresponding to an infinitesimal change in the quantity produced (marginal concept).

In mathematical terms, the new definition means that $a_1 dA$ is the quantity of (T) which is necessary to produce dA of (A), in addition to A of (A); B of (B), etc. $a_2, \ldots b_1, \ldots b_2, \ldots$ have analogous meanings.

Of these coefficients, some are constant, others vary with the output of the commodity, and still others present a special kind of variation: they are associated in such a way that a decrease in some of them may be compensated by an increase in the others, which may be expressed mathematically by the equation

$$f(b_1, b_2, \ldots b_s) = 0. \qquad [16]$$

[17] *Manuel d'économie politique*, Appendice, §78, pp. 607–8. See also pp. 608–38.

In his *Encyclopédie* article (1911)—see note 16 above—Pareto adds a constant to each of the equations in [14] which represents the quantity of the factor or service which it is necessary to use up before beginning production. (See §43 of that article.) The inclusion of these constants has no effect on the definitions of coefficients of production, as they vanish in the differentiation.

In the *Manuel* (1909) and in his subsequent publications, Pareto also adopted a different notation for the coefficients of production. Thus, he would write t_a, for a_1; t_b, for b_1; k_b, for b_k; etc., the commodity (instead of the service) being designated by the subscript.

This assumption is more general and more reasonable than that of the marginal-productivity theory of Walras, which is that *all* of the coefficients of production relating to any commodity—say, (B)—are compensatory. (See equation [3]).

In adopting the new definition [15] in place of Walras' definition [4] for the coefficients of production, Pareto appears to have bid adieu to the marginal-productivity theory. For, when the coefficients are defined as partial derivatives, even if they are all assumed to be connected by only one relation such as [3], as are Walras' coefficients, it appears impossible to prove that [3] leads to a production function [7] which is homogeneous, and of the first degree in $T, \ldots P, \ldots K, \ldots$.

To say that some of the coefficients of production vary only with the quantity of the product is to assume that for a given output they are determined *exclusively by technical considerations*. To any given output there corresponds one and only one value of such a coefficient of production. (This does not mean, however, that the output is not affected by economic considerations.) This is true *a fortiori* of constant coefficients.

To say that some of the coefficients are compensatory is to assume that they will be determined by *economic considerations* —say, the prices of the services of the factors—the technical considerations simply determining the extent to which it is physically possible to vary any one coefficient so as to compensate for a change in any of the others. Within this range, economic considerations may exert their influence.

B. LAWS OF COST WHEN THE COEFFICIENTS OF PRODUCTION DEPEND ON TECHNICAL CONSIDERATIONS

Let us first consider the laws of cost when the coefficients of production are determined exclusively by technical considerations.

Let $\pi_a, \pi_b, \ldots$ be the unit costs of production of $A, B, \ldots$.

Let the production of $A, B, \ldots$ be independent of one another. (Otherwise it is possible to obtain only the joint cost of production.)

The cost of producing dA, dB, . . . , when there have already been produced A of (A), B of (B), etc., will be

$$\left.\begin{aligned} \pi_a dA &= (p_t a_t + \cdots + p_p a_p + \cdots + p_k a_k + \cdots)dA \\ \pi_b dB &= (p_t b_t + \cdots + p_p b_p + \cdots + p_k b_k + \cdots)dB \\ &\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \end{aligned}\right\} . \qquad [17]$$

For independent productions we assume, in general, that a_t, a_p, . . . depend only on the output A of (A); that b_t, b_p, . . . depend only on the output B of (B); etc. In that case we have for the total costs of production, Π_a, Π_b, . . . of A, B, . . . (assuming free competition or constant prices),

$$\left.\begin{aligned} \Pi_a &= \pi_{o.a} + \int_o^A \pi_a dA \\ \Pi_b &= \pi_{o.b} + \int_o^B \pi_b dB \\ &\cdots\cdots\cdots \end{aligned}\right\} , \qquad [18]$$

$\pi_{o.a}$, $\pi_{o.b}$, . . . being the general expenses which do not vary with the output. The law of cost when the coefficients of production are constant, and when general expenses are present or absent, are special cases of [18].

These equations take the place of equations [1] of the Walrasian system; they must be solved simultaneously with all the other equations which determine the economic equilibrium, for the cost of production of a commodity is not a given element in the pricing system; it is a function of the unknowns of the system.

But it is not sufficient to say that the problem of production admits of a solution because it gives rise to as many equations as there are unknowns. We must also know the economic significance of this solution. If we accept the Lausanne school concept of free competition,[18] we may say that if the production of any

[18] This concept involves the assumption that the entrepreneur makes neither gain nor loss, receiving only wages of management. This doctrine has been severely criticized by several economists, and especially by Edgeworth. See his *Papers Relating to Political Economy*, index references under "Entrepreneur," "Pareto," "Walras."

commodity—say, (X)—is carried on rigorously under that régime,[19] the conditions of equilibrium require (1) that the total receipts (P_x) from the sale of the commodity shall be equal to the total costs (Π_x) incurred in its production, and (2) that the price (p_x) of the commodity shall be equal to its marginal cost (π_x). In symbols,

$$\left.\begin{aligned} P_x &= \Pi_x \\ p_x &= \pi_x \end{aligned}\right\}. \qquad [19]$$

But these two equations may be incompatible.

In reality, argues Pareto, we must have, under free competition, the relation: total receipts are *at least equal* to total costs, and price is *at least equal* to marginal cost; or,

$$\left.\begin{aligned} P_x &\geqq \Pi_x \\ p_x &\geqq \pi_x \end{aligned}\right\}. \qquad [20]$$

Where the equality is possible, as when the coefficients of production are constant and when there are no general expenses, we have equations [19]. When it is not possible, we have the two following cases: (α) total receipts exceed total costs, and price is equal to marginal cost:

$$\left.\begin{aligned} P_x &> \Pi_x \\ p_x &= \pi_x \end{aligned}\right\}; \qquad [20\alpha]$$

or, (β) total receipts are equal to total costs, and price exceeds marginal cost:[20]

$$\left.\begin{aligned} P_x &= \Pi_x \\ p_x &> \pi_x \end{aligned}\right\}. \qquad [20\beta]$$

[19] Or, rather, when the liaisons are of Pareto's Type I. See paragraph 45 of his paper on "Économie mathématique" in the *Encyclopédie des Sciences Mathématiques*, Tome I, Vol. IV, fascicule 4, pp. 591–640.

Equations [19] and [20] are in the notation of the *Encyclopédie* paper, which differs from that of the *Manuel*.

[20] In his *Encyclopédie* article, Pareto does not define π_x as the marginal cost, but simply as "le prix de revient." However, the use which he makes of it in connection with such equations as [15], [17], and [18] suggests that this interpretation is valid.

These cases[21] are associated with the phenomenon of *rent*, which Pareto has generalized to an extent undreamed of by the early economists, and the consequences of which have not as yet been fully explored. Rent, according to Pareto, arises from the varying difficulties with which savings can be transformed into certain kinds of capital. "The possessors of capital goods [*capitaux*] into which savings cannot be transformed without great difficulties, get a profit from certain changes in the economic situation, competition being unable, at least by new transformations of savings, to annul the advantages which they possess."[22] *This is rent.* It may be a positive quantity (gain); or a negative quantity (loss). Ricardian rent is a special case of the more general phenomenon. Thus, when total receipts cannot be equal to total costs at the same time that price is equal to marginal cost, or vice versa, we know that the capital goods whose services are used in making the commodity in question are such that savings cannot be transformed into them with uniform difficulty. The agents of production into which savings cannot be transformed without relatively great difficulties yield a *rent* to their owners. The question of the relation between cost and price is largely a question of whether these *rents* are or are not to be counted as costs. This is an important subject, but a detailed consideration of it must be left for another occasion.

C. LAWS OF COST WHEN THE COEFFICIENTS OF PRODUCTION DEPEND ON ECONOMIC CONSIDERATIONS

In the preceding analysis we have confined our attention to those coefficients of production which are functions of the output, or which, for a given output, are determined exclusively by technical considerations. We must now also consider the problem of the compensatory coefficients [16], the determination of which depends both on technical and economic considerations.

[21] Graphical illustrations of these cases, and a discussion of their significance from a partial equilibrium point of view, may be found in Henry Schultz, *Statistical Laws of Demand and Supply with Special Application to Sugar* (1928), pp. 114–24.

[22] Vilfredo Pareto, *Cours d'économie politique*, Vol. II, paragraphs 745–70. Pareto's discussion of Ricardian rent, from the equilibrium point of view, throws a flood of light on that subject.

This is a much more difficult problem, from both the economic and the mathematical points of view.

The problem may be stated as follows: Equations [18], giving the total costs of production of $A, B, \ldots$ may be written as:

$$\left.\begin{aligned} \Pi_a &= \pi_{o.a} + \int_o^A (p_i a_i + \cdots + p_p a_p + \cdots + p_k a_k + \cdots)\, dA \\ \Pi_b &= \pi_{o.b} + \int_o^B (p_i b_i + \cdots + p_p b_p + \cdots + p_k b_k + \cdots)\, dB \\ &\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \end{aligned}\right\}. \quad [21]$$

It is required to determine the coefficients of production, subject to the condition that a group of them—say, those entering into the second equation—be connected by the law:

$$f(b_i, b_p, \ldots b_s) = 0\,. \quad [16]$$

The broad outline of the economics of the solution is not difficult to grasp. Let us assume—as we have done throughout this paper—conditions of free competition. (The solution would be different under monopoly conditions.) This means that each entrepreneur accepts the system of prices that he finds in the market, and, without seeking to modify them directly, so organizes his productive resources—always in accordance with condition [16]—as to minimize his cost of production or to maximize his net revenue. It is on this principle that he determines his coefficients of production.

But without wishing to do so, our entrepreneur will, by this very action, help to modify the market prices. True, the output which he throws on the market and the productive services which he hires or purchases are all too small as compared with their respective total amounts appreciably to modify their market prices. But each of his competitors is also acting on the same assumption. The cumulative effect of their activities leads to a large change in the output of the commodity and a large modification in the demand for the productive services, which in turn lead to a modification of the prices on which the entrepreneurs based their computations. The result of this change is that the

various entrepreneurs find themselves again not producing maximum profit outputs. While some of them are still making money, others are producing at a loss.[23]

Each entrepreneur will now make a new set of computations, using the new market prices and total output as a basis, and will make a new determination of the coefficients, with the view of maximizing his profits under the new conditions. This process, which goes on indefinitely, will, in theory, come to a stop when each entrepreneur is producing an output corresponding to his lowest possible unit cost, or, in the language of the Lausanne school, when he has reached a point where there is no longer any profit or loss. The coefficients of production, as well as the other unknowns, will then attain their equilibrium values.

The mathematical translation of this process involves the notions of the calculus of variations. When one varies the coefficients b_l, b_p, . . . , the corresponding variations in the total cost of producing B will be (see equations [21]):

$$\delta\Pi_b = \int_o^B (p_c\delta b_c + \cdots + p_p\delta b_p + \cdots + p_k\delta b_k + \cdots + b_c\delta p_c + \cdots + b_p\delta p_p + \cdots + b_k\delta p_k + \cdots)\, dB \quad . \quad [22]$$

Since the entrepreneurs accept the market prices as given, it means that they take no account of possible variations in the prices, or that they are proceeding as if

$$\delta\Pi_b = \int_o^B (p_c\delta b_c + \cdots + p_p\delta b_p + \cdots + p_k\delta b_k + \cdots)\, dB \, . \quad [23]$$

For the total cost Π_b to be a minimum, this equation must be put equal to zero. This minimum would be attained if the prices were to remain constant. As they do not, the entrepreneurs will be compelled to recast their cost schedules, using the new prices for a basis. For equilibrium to be attained we must have

$$0 = \int_o^B (p_c\delta b_c + \cdots + p_p\delta b_p + \cdots + p_k\delta b_k + \cdots)\, dB \, . \quad [24]$$

Similarly for the commodities (A), (C), etc.

[23] Fig. 2, p. 532, may be made to show a loss, by lowering the price line BP to a point below H, the lowest average cost per unit.

If the equilibrium is to maintain itself, equation [24] must be satisfied at the same time as all the other equations of the system.

If we have only equation [16] connecting the group of r coefficients under consideration, one of them, b_t for example, may be assumed as a function of the others, $b_p, \ldots b_s$, which are then independent variables. It can be shown[24] that equation [24] involves $(r-1)$ equations of the type:

$$\left.\begin{array}{l} p_t \dfrac{\partial b_t}{\partial b_p} + p_p = 0 \\ \cdots\cdots\cdots \\ p_t \dfrac{\partial b_t}{\partial b_k} + p_k = 0 \\ \cdots\cdots\cdots \end{array}\right\}, \qquad [25]$$

which give the values of the coefficients, which render the cost of production a minimum. They correspond to equations [12] of the marginal-productivity theory.

The partial derivatives of b_t may be obtained from equation [16]. Adding the $(r-1)$ equations [25] to equation [16], we obtain r equations, equal in number to the r coefficients.

If there be another group of compensatory coefficients, the foregoing procedure again leads to a number of equations equal to the number of unknowns. These equations must exist simultaneously with all the other equations of equilibrium. They do not remove the difficulties raised by conditions [20].

D. SUMMARY AND CONCLUSIONS

It was necessary to trace the foregoing outline of the solution of the problem of production with variable coefficients partly for its inherent importance—there is no other summary of it in English—but primarily for the purpose of showing that it is neither necessary nor desirable to make the highly unreal assumptions of the marginal-productivity theory in order to solve all the unknowns of the problem of production.

These assumptions, which are rarely, if ever, explicitly stated by the protagonists of the marginal-productivity approach,

[24] Vilfredo Pareto, *Manuel d'économie politique*, pp. 633–34.

are (1) that *all* the coefficients of production for a commodity are variable; (2) that they are connected by only one functional relation, such as [3]; and (3) that an increase in any one coefficient must be compensated by a decrease in one or more of the others, *irrespective of the quantity produced*, which means, in mathematical terms, that the output cannot enter explicitly into the function [3] ≡ [6] connecting the coefficients of production.

It is only when these assumptions are realized that the variations in the productive services are independent of one another and the concept of marginal productivity has meaning. It is only when these assumptions are realized that an increase of each productive service by a given percentage will cause an increase in the output by the same percentage (Euler's theorem). And it is this property of the production function which enables us to deduce the fundamental theorem of the marginal-productivity theory, namely, that the marginal productivity of a service is equal to the ratio of the price of the service to the price of the commodity. When even one of the coefficients of production is constant; or, when even one coefficient varies with the output; or, more generally, when one group of coefficients is connected by one equation and another group by another equation, then the productive services cannot be varied independently of one another, and the marginal-productivity theory fails.

The *general* solution of the problem of production, of which only an incomplete outline was sketched in the preceeding pages, is not subject to these limitations. On the contrary, it assumes that some coefficients of production are constant, that others vary with the output of the commodity, and that still others present a special kind of variation: a decrease in some of them may be compensated by an increase in the others; and it determines the values of all these coefficients by postulating that the cost of production shall be a minimum. This throws light on the effects of competition among producers, on rent, and on the relation between cost and price in the short run and in the long run. It is thus a far cry from the oversimplified solution of the marginal-productivity theory.

This does not mean to say, however, that the general solu-

tion is not also an oversimplification. True, it also treats of such important problems as the size of the firm, maximum utility *(ophélimité)*, monopoly, and collectivism, none of which is even mentioned in the summary presented above. But the theory is nevertheless a static theory, as Pareto himself takes pains to point out. There is little in it which will explain the secular and cyclical changes in production, the rôles played by changes in money and credit phenomena, etc. Nevertheless, it is a better approximation to the facts of economic experience than is Walras' construction. That further approximations are necessary is brilliantly argued by Pareto himself. In fact, he calls applied economics not an art, but a science.[25] The problem of providing second and higher order approximations to the cost-price theory is tremendously complex. Only those who have struggled with it or with similar problems are in a position fully to appreciate Marshall's judgment that "a man is likely to be a better economist if he trusts to his common sense, and practical instincts, than if he professes to study the theory of value and is resolved to find it easy."[26]

VI. COST OF PRODUCTION, SUPPLY, DEMAND

The foregoing theory may be made more intelligible and concrete by an illustration, which will also serve the purpose of putting in a clearer light the problem of statistical verification.

The greatest difficulty in the way of a verification is the lack of reliable data from which to deduce coefficients of production. True, Federal and state agencies gather and publish cost-of-production data of various kinds, but they are generally useless for present purposes.[27] What is greatly needed is a series of well-planned *experiments* on the relation between input and output (coefficients of production) in various fields of production. The results of such experiments not only would throw a flood of light

[25] See Vilfredo Pareto, *Cours d'économie politique*, Vol. I, §35, pp. 16–17, which contains a suggestive discussion of the rôle of successive approximations in science.

[26] Alfred Marshall, *Principles of Economics* (8th ed.), p. 368.

[27] One exception must be mentioned, and that is *U.S. Dept. Agr. Bull. No. 1377* (September 18, 1924). (See note 6, p. 510, above.)

on problems of pure theory but also would be of great value to the industries concerned.

Let us assume that the experiments have been made, or that the present data are better than they are, and that they are available for each producer. We say *for each producer* because it is necessary to begin the analysis with the individual firm in order to get an insight into the cost-price relation.

The data may be made to yield coefficients of production either of the Walrasian type defined by [4] and corresponding to the *average* concept, i.e., to the agricultural economist's "input per unit of output"; or of the Pareto type, defined by [15] and corresponding to the *marginal* concept.

It is probably a little more convenient for our immediate purposes to work with the Walrasian coefficients, since the concept "input per unit of output" has already gained some currency, notwithstanding the fact that the equations of the previous section are based on Pareto's later definition. It will be shown later that the final result is unaffected whichever procedure is adopted, the only difference being that in the first procedure it is more convenient to work with *average* costs, while in the second procedure it is more convenient to work with *marginal* costs.

In general, some of these coefficients will be fixed, others will vary only with the output, and still others will form a group or groups of compensatory coefficients connected by some such equation as [3].

Figure 1 is an hypothetical representation of the first two groups of coefficients. Thus b_k (=constant) may relate to raw material; b_w, to power; b_s, to supervision; b_v to labor hours; and b_t to building. The graph cannot well show the compensatory coefficients since they are also functions of all the prices. These will be taken into account later. The ordinates of these coefficients are not comparable, since they are expressed in different physical units and have not as yet been reduced to their only common denominator—cost.

The aim of the entrepreneur is to maximize his profits on the basis of the system of prices which he finds in the market. In

general, there is only one output corresponding to a maximum profit. It may be found as follows.

If we multiply each coefficient by the price per unit of the service to which it relates (the prices being assumed constant), we shall obtain the (average) cost per unit, *exclusive of the unit costs of the compensatory services.* But to any given system of

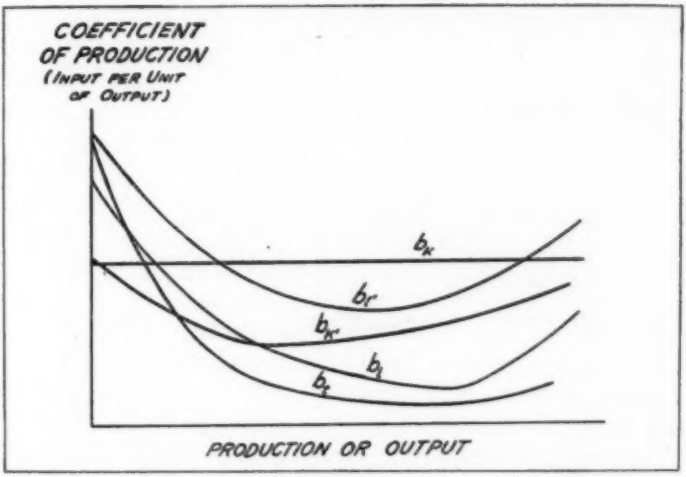


FIG. 1.—Probable relation between coefficients of production and output. (Compensatory coefficients are not shown.)

prices there corresponds a least-cost combination of these coefficients, by [25]. When the cost of the compensatory services is added to that already obtained, we get the (average) cost per unit (c_b) of the commodity in question (B) as a function of the quantity produced, or

$$c_b = b_l p_l + \cdots + b_{l'} p_l + \cdots + b_k p_k + \cdots . \qquad [26]$$

In Figure 2, the average cost curve is CD, and the (constant) price is the ordinate of the horizontal line BP. The lowest average cost per unit is FH, corresponding to the output OF. But this is not the highest-profit combination. For a market

price $OB=MP$, the highest-profit output is OM, and the corresponding average cost is MN.

How is the highest-profit combination determined? By finding the output for which the *marginal* cost is equal to the (constant) market price, and by taking the average cost corresponding to that marginal cost. The proof is as follows:

Let p_b, c_b, q_b, represent respectively the price, average cost, and output of the commodity in question.

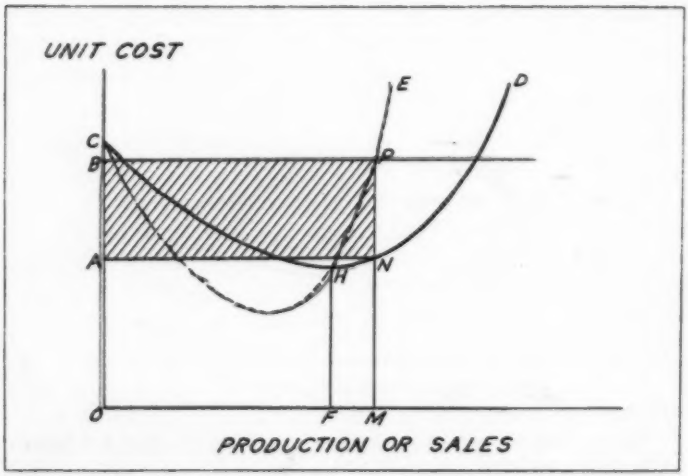


FIG. 2.—Probable relation between unit cost and price
CHD=average-cost curve;
CHE=marginal-cost curve;
PM=price;
shaded rectangle=maximum profit.

The entrepreneur attempts to maximize his net returns, G_b,

$$G_b=(p_b-c_b)q_b\,. \qquad [27]$$

The necessary condition for a maximum is that

$$\frac{dG_b}{dq_b}=\frac{d[(p_b-c_b)q_b]}{dq_b}=0\,, \qquad [28]$$

which gives

$$p_b - \frac{d(c_b q_b)}{dq_b} = 0 ,$$

or

$$p_b = \frac{d(c_b q_b)}{dq_b} . \qquad [29]$$

But the right-hand expression of [29] is the derivative of the total-cost function $(c_b q_b)$ with respect to the output (q_b), and this, by definition, is the marginal cost.[28]

In Figure 2, the marginal-cost curve is represented by the curve *CHPE*, the net gains (maximum profit) by the shaded rectangle *ABPN*, and condition [29] by the ordinate *MP* of the point of intersection of the marginal-cost curve and the horizontal line representing the price. The most profitable output is *OM*, corresponding to the average cost *MN*.

Proceeding in this manner, we obtain the most profitable output for all the other producers.

Thus we see that the use of the *average*-cost curve in connection with the maximum condition [27] leads to a consideration of the *marginal*-cost curve. We may, therefore, start our analysis with the coefficients of production as defined by Pareto and work with marginal-cost curves from the beginning.

The marginal-cost curves for commodities (A), (B), . . . are defined by [17]. The relation between the marginal- and the average-cost curves is shown in Figure 2. For a detailed discussion of the relation between the two curves and related curves, methods of construction, and related subjects, the reader is referred to pages 104–24 of the author's *Statistical Laws of Demand and Supply with Special Application to Sugar*.

[28] That under free competition and when each producer's cost curve is positively inclined, marginal cost is equal to price, was first proved by Cournot (*Researches into the Mathematical Principles of the Theory of Wealth*, Bacon's translation, paragraph 50) in 1838. Cournot developed his proof by first considering a monopoly condition and then greatly increasing the number of competitors.

F. Divisia (*Économique rationnelle* [Paris, 1928], pp. 130–31) also deduces [29] from [27], without, however, going into the problem of the coefficients of production; and he also gives an explanation of the construction of the supply curve from the cost curve.

A glance at Figure 2 shows that the marginal-cost curve is below the average-cost curve when the latter is negatively inclined, and that it is above the average-cost curve when the latter is positively inclined. When the average-cost curve has no slope, the two curves coincide.

In the present analysis we may neglect the negatively sloping portion of the marginal-cost curve, for the reason that a descending-cost curve is incompatible with the assumption of free competition.[29] When the cost curve descends to the right, we have a condition which *in theory* should lead to cutthroat competition and ultimately to monopoly. In practice "economic friction" may prevent a monopoly from being attained.

Confining our attention to the positively sloping branch of each producer's marginal-cost curve, we may say that each entrepreneur maximizes his profits when he carries his output up to the point where the increase in cost due to the production of an additional (small) unit would just exceed the market price. This is condition [29].

But the market prices of the product and the services on which each entrepreneur based his computations of the most profitable output will not remain unaltered as soon as the output of all the producers begins to reach the market, and as soon as new producers enter the field. This means a new attempt on the part of each producer either to avoid losses[30] or to determine his most profitable output under the changed conditions, resulting in modification of the cost curve and in the establishment of a new equilibrium.

As far as any individual producer is concerned, the new situation involves a movement of the point N (Fig. 2) to the right or to the left of its present position, depending upon whether the new price is higher or lower than the old; and the point will lie on a new average-cost curve. If, however, we wish to show also the *resultant* of the actions of the individual entrepreneurs, we

[29] This is a disputed question.

[30] Losses will occur when the new price line is below the point of lowest average cost, or when the price line *BP* (Fig. 2, p. 532) drops below the point *H* on the average cost curve *CHD*.

must replace the fixed price (ordinate of the horizontal line *BP*) by the market *demand curve* for the commodity, and proceed as follows:

From the marginal-cost curves for the various producers we construct an *aggregative* or market marginal-cost curve. This is done by adding for each marginal cost the amounts supplied by all producers at that cost and taking this sum as the abscissa of

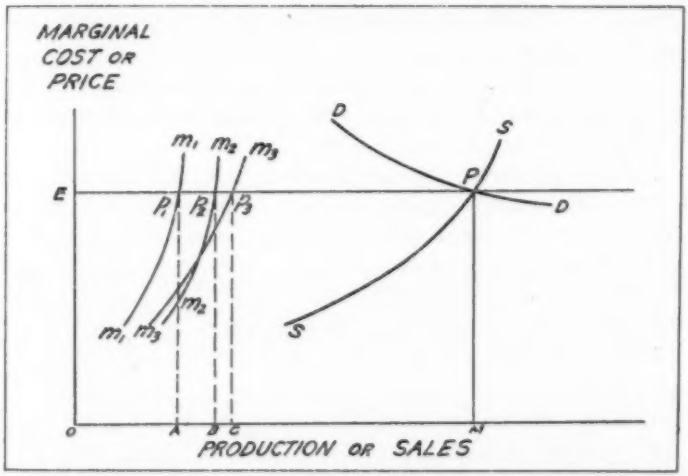


FIG. 3.—Probable relation between the marginal-cost curves of the individual firms, the market-supply curve, and the market-demand curve.

the aggregative market curve, the ordinate as before representing marginal cost. The resulting curve is the market-supply curve. Figure 3 is an illustration of this procedure. The market-demand curve is *DD*. The marginal-cost curves (positive branches only) for the individual producers are m_1m_1, m_2m_2, and m_3m_3. Of course, if there were only three producers the price problem would be indeterminate, and recourse would have to be had to the "indifference-curve" method.[31] This small number is used for illustrative purposes only. The supply curve is *SS*. It is so constructed that the abscissa of *any* point on it is equal to the

[31] See F. Y. Edgeworth, *Mathematical Psychics* (London, 1888), pp. 16–51.

sum of the corresponding abscissas of the three marginal cost curves. Thus, $EP=Ep_1+Ep_2+Ep_3$.

The market supply curve SS is now brought into juxtaposition with the demand curve DD, which must be assumed as given. The point of intersection of the two curves gives by its ordinate PM the equilibrium market price and by its abscissa OM the corresponding total quantity sold. As soon as the market price is known the output of each producer can be determined. Thus OA, OB, OC, are the outputs of the three producers considered in Figure 3.

A glance at Figure 3 also shows that when equilibrium has been established, the marginal cost of each producer is equal to the market price ($p_1A=p_2B=p_3C=PM$).

It can be shown that the foregoing procedure involves the solution of as many equations as there are unknowns.[32] Knowing the marginal-cost function, we can easily determine the marginal productivity of each service. But these marginal productivities do not bear the simple relation to the prices of the service and of the commodity that they do in the marginal-productivity theory.

The equilibrium thus established will not, however, remain undisturbed, for two reasons: First, the market price will not in general be the one on which the various producers based their computations of maximum profit. Second, as long as some producers are making a profit, new producers will be tempted to enter the field. The result will be a series of adjustments to the new situation, giving rise to a new set of cost curves and a new market price. This competition will have the effect of *ultimately* (never realized, but giving rise to a moving equilibrium) compelling all entrepreneurs to adjust their output until they have reached the point of *lowest average costs*. The marginal cost of each entrepreneur will then be equal to his lowest average cost, and both will coincide with the market price.

It is reasonable to suppose that the final cost curves which will thus emerge from the many modifications of the old cost curves will, in general, have only one minimum point, so that curve CD of Figure 2 will also serve as a graphic illustration of

[32] See F. Divisia, *Économique rationnelle*, p. 130.

the final equilibrium situation for a typical producer. His long-time equilibrium cost will be HF, which is the ordinate of the lowest point H on the average-cost curve.

It can easily be shown that the marginal-cost curve CHE intersects the average-cost curve at the point H, so that for the long-time normal output OF, the average cost is equal to the marginal cost and is also equal to the price.[33] This will be the same for all other producers and will be equal to the long-time equilibrium price. The output of the producer in question will be OF. The output of the entire industry will be the sum of the lowest-cost outputs of the various producers. The commodity will then be produced under conditions of uniform cost. In other words, the relations

$$\left.\begin{aligned} P_x &= \Pi_x \\ p_x &= \pi_x \end{aligned}\right\} \qquad [19]$$

will then be satisfied, and the entrepreneurs will make neither profit nor loss. But this may be impossible of realization, as is the case when the cost curve rises from the very start (see pp. 522–24).

A thoroughgoing consideration of this question would involve an analysis of the relations between internal and external economies, and the effect of these relations on the moving general equilibrium. To a certain extent, account was indirectly taken in the foregoing discussion of the effect of external economies, when it was assumed that changes in the number of pro-

[33] From equation [29], p. 533, we have

$$p_b = \frac{d[c_b q_b]}{dq_b} = c_b + q_b \frac{dc_b}{dq_b}.$$

At the lowest point on the average cost curve the slope is zero. Equating

$$\frac{dc_b}{dq_b}$$

to zero, we obtain

$$p_b = \frac{d[c_b q_b]}{dq_b} = c_b,$$

which was to be proved.

ducers affect the market price. But a detailed discussion of this question and related subjects is beyond the scope of this paper.

If the supply and demand approach leads, as we have just seen, to the same results as those obtained by the general equilibrium approach of the preceding section, one may ask, "Why bother with coefficients of production? Why not work only with supply and demand functions?" The answer is, first, that the supply and demand formulas simply translate the *result* of a process without explaining it; and, second, that they assume that *all other things remain equal* while the supply curve or the demand curve of one commodity undergoes a change. This assumption is not, in general, in agreement with the facts, though it greatly simplifies the theory. We must say of the demand and supply equations what was said of the other cost-price equations: they must be satisfied simultaneously with all the other conditions of general equilibrium.

VII. THE COBB-DOUGLAS STATISTICAL STUDY OF PRODUCTIVITY

In their paper on "A Theory of Production"[34] Professors Charles W. Cobb and Paul H. Douglas attempt, among other things, to determine statistically the relative influence upon production of labor as compared with capital, or to determine the marginal productivity of labor and capital, during the interval 1899–1922.

The composite of the many heterogeneous elements usually designated by the term "labor" is represented by an index of the probable average number of wage-earners employed in manufacturing, 1899=100.

"Capital" is represented by an index of the total fixed capital in manufacturing, 1899=100.

Working capital and land values are excluded from the index —the former, because the authors wish "to measure [only] the capital which aids in the production of goods"; the latter, because they are "largely composed of the unearned increment" (p. 140).

[34] Charles W. Cobb and Paul H. Douglas, "A Theory of Production," *American Economic Review*, Vol. XVIII, No. 1, Supplement (March, 1928), pp. 139–72.

"Production" is measured by an index of physical volume of manufactures, 1899=100.

The relation between the product (P) on the one hand and labor (L) and capital (C) on the other, is then expressed by the formula

$$P' = 1.01\, L^{3/4} C^{1/4} \qquad [30]$$

where P' is the computed, or probable, value of P.

This is a homogeneous function of the first degree in labor and capital, so that if we multiply both labor and capital by a factor λ, production will also be multiplied by λ. This equation imputes three quarters of the product to labor and one quarter to capital.

Such are, briefly, the essential features of this most interesting contribution to the very important subject of production.

A discussion of the many statistical questions raised by the Cobb-Douglas paper is beyond the scope of the present study. As to its theoretical implications, however, a few comments are in order.

1. The failure of these authors to include "land" and working capital among the productive services means that their problem is virtually identical with that in which it is desired to determine the marginal productivities and the shares of only two of the several productive services, on the assumption that the other services do not exist.

2. The theory of production which has supplied the theoretical inspiration to their statistical attack is the marginal-productivity theory of J. B. Clark, P. H. Wicksteed, *et al.* It is an incomplete version of Walras' productivity theory discussed in section III of this paper, *and is subject to same limitations.*[85] Furthermore, Wicksteed himself, educated by the criticisms of Pareto and Edgeworth, abandoned in 1910 his earlier assumption that the production function is such that if we increase each of the factors by a given percentage the product will increase by the same percentage.[86] This does not mean that a homogeneous function of the first degree should be avoided in all statistical

[85] See pp. 527–29, above.

[86] See Philip H. Wicksteed, *Common Sense of Political Economy* (1910), p. 373, n. 1.

studies of production, but rather that its theoretical limitations should be kept in mind and that it should not be advanced except as a first approximation.

3. Even if we accept the marginal-productivity theory as a first approximation to a law of production, the statistical procedure adopted by the authors cannot, in general, lead to a verification of it. The productivity theory is a static theory, Walras to the contrary notwithstanding. In order to verify it statistically, one must first adjust his time series for at least some of the secular changes. This our authors have failed to do. Their equation [30] is based on index numbers of production, labor, and capital, which have not been adjusted in any way for secular or other changes. It cannot, therefore, be taken as an approximation to the production equation which is postulated in the marginal-productivity theory.

This point is made not because it is new nor because it is not recognized by our authors. In fact, Professor Douglas' program for further work contemplates the elimination of the time element as far as possible.[37] It is made for an entirely different reason. If we are ever going to develop what Professor Henry L. Moore calls "a statistical complement to pure theory," we shall need not only statistical laws of demand and supply but also statistical laws of production. In statistical studies of demand and supply, there are first deduced the short-time, reversible, demand and supply curves from the short-time fluctuations in the quantity and price series. The methods of trend ratios, link relatives, first differences, etc., are illustrations of this procedure. The short-time demand and supply curves are then superimposed on the *trends* of consumption (or production) and prices, and there is thus obtained a measure of the shifting of the demand and supply curves from year to year as a result of dynamic changes, or a moving equilibrium of demand and supply.[38] Nothing in this procedure prevents one from studying also the relations between the *trends* of production, consumption, and prices. On the contrary, the long-time (trend) relations are utilized in measuring the shifting of the short-time curves. But

[37] Charles W. Cobb and Paul H. Douglas, *op. cit.*, p. 165.

[38] See H. Schultz, *op. cit.*, pp. 165–67, and 188–89.

the emphasis is generally placed on the latter, as the object is first to isolate the short-time curves, and then to show how they change their position from time to time. The Cobb-Douglas procedure marks, for the time being, a notable departure from the demand and supply procedure.

4. If the Cobb-Douglas formula does not constitute a verification of the statical marginal productivity theory, is it then of no value? Not at all! For a good many purposes, it may be much more significant than the statical productivity formula. If, for example, it should be found that a considerable number of countries have (long-time) productivity curves of the same shape, this will have a most important bearing on many economic questions. The work of these authors would, however, gain in utility and significance if their procedure were modified so as to lead also to short-time productivity curves and to a consideration of the shifting of these curves from time to time.

It must be emphasized that the foregoing suggestion is to the effect that the present Cobb-Douglas procedure be modified, not abandoned; for it is not certain that the methods which lead to good results in the statistical study of demand will also lead to good results in the statistical study of production. Experimentation with various methods will be necessary before an answer can be given to this question. For the time being, statistical economists will do well not to dismiss the study in question on the ground that the secular trends have not been removed. While we are well aware of the danger of spurious correlation to which the trends may give rise, nevertheless we submit that in studies of demand,[39] supply, and marginal productivity, it is often difficult to decide *a priori* whether the secular trends under consideration should be removed entirely, in part, or not at all. In such a situation a healthy skepticism of accepted methods is of considerable utility. In this connection it is well to keep in mind a pregnant dictum of Pierre Boutroux: ". . . . in the early days of algebra [statistical economics], those who succeeded most in this science were the ones who had no theoretical scruples."[40]

[39] See *ibid.*, pp. 78–79.

[40] Pierre Boutroux, *L'idéal scientifique des mathématiciens dans l'antiquité et dans les temps modernes* (1928), p. 89.

APPENDIX I

(See pp. 511–13)

EULER'S THEOREM AND THE PRODUCTION EQUATION

A. EULER'S THEOREM

A function $f(x, y, z, \ldots)$ is said to be *homogeneous* if, when each of the variables is multiplied by one and the same quantity, the function is merely multiplied by a power of this quantity. In symbols, the condition for homogeneity is

$$f(\lambda x, \lambda y, \lambda z, \ldots) = \lambda^n f(x, y, z, \ldots),$$

where λ is an arbitrary quantity. The exponent n of λ is called the *degree* of the function.

Thus the functions

$$u = ax^2 + bxy + cy^2$$

$$u = z \arctan \frac{y}{x}$$

$$u = kxy$$

$$u = kx^a y^{1-a}$$

are respectively of degrees 2, 1, 2, 1.

These functions may be given an economic interpretation, as follows: In each of these equations, let x, y, and z stand for three different productive services, and u for the output of the commodity. When the production function is of the *first* degree (the second or fourth, above), doubling of each productive service will double the product u $(2^1 = 2)$. When the production function is of the *second degree* (the first or third above), a doubling of each productive service will quadruple the output $(2^2 = 4)$.

The increase, du, in a continuous function $u = f(x, y, z, \ldots)$ is (subject to certain conditions)

$$du = \frac{\partial u}{\partial x} dx + \frac{\partial u}{\partial y} dy + \frac{\partial u}{\partial z} dz + \cdots.$$

If, however, u is also a *homogeneous function of degree n*, the foregoing formula becomes

$$nu=\frac{\partial u}{\partial x}x+\frac{\partial u}{\partial y}y+\frac{\partial u}{\partial z}z+\cdots .$$

This result is known as "Euler's theorem on homogeneous functions." (See Edwin B. Wilson's *Advanced Calculus*, chap. iv, §53.)

B. THE PRODUCTION EQUATION

The proof that the production equation

$$Q_b=F_b(T,\ldots P,\ldots K,\ldots) \qquad [7]$$

is a homogeneous function of the first degree in $T, \ldots P, \ldots K, \ldots$ is as follows:

By definition, the compensatory coefficients are connected by the function

$$\phi_b(b_t,\ldots b_p,\ldots b_k,\ldots)\equiv\phi_b\left(\frac{T}{Q_b},\ldots\frac{P}{Q_b},\ldots\frac{K}{Q_b},\ldots\right)=0. \qquad [i]$$

Since by hypothesis Q_b does not enter in an explicit manner in [i], we can, by the fundamental theorem on implicit functions,[1] theoretically obtain a *unique* solution for Q_b in some restricted region of $T, \ldots P, \ldots K, \ldots$ and Q_b, provided (1) that

$$\frac{\partial\phi_b}{\partial b_t}\neq 0,\ \ldots\ \frac{\partial\phi_b}{\partial b_p}\neq 0,\ \ldots\ \frac{\partial\phi_b}{\partial b_k}\neq 0,\ \ldots ,$$

and (2) that Q_b is not a homogeneous function in $b_t, \ldots b_p, \ldots b_k, \ldots$, the condition for which in virtue of Euler's theorem and the condition $\phi_b=0$, is that

$$\frac{\partial\phi_b}{\partial b_t}b_t+\cdots+\frac{\partial\phi_b}{\partial b_p}b_p+\cdots+\frac{\partial\phi_b}{\partial b_k}b_k+\cdots\neq 0 .$$

[1] See Goursat-Hedrick, *Mathematical Analysis*, Vol. I, chap. ii, §20; William F. Osgood, *Advanced Calculus*, chap. v, §12; or Edwin B. Wilson, *Advanced Calculus*, chap. v, §56.

Let this unique solution be

$$Q_b = F_b(T, \ldots P, \ldots K, \ldots) . \qquad \text{[ii]}$$

Multiply $T, \ldots P, \ldots K, \ldots$ by an arbitrary constant, λ. Q_b will then assume a value $Q'_b \neq Q_b$ in order to satisfy [i]. We then have

$$\phi_b\left(\frac{\lambda T}{Q'_b}, \ldots \frac{\lambda P}{Q'_b}, \ldots \frac{\lambda K}{Q'_b}, \ldots\right) = 0 \qquad \text{[iii]}$$

and

$$Q'_b = F_b(\lambda T, \ldots \lambda P, \ldots \lambda K, \ldots) \qquad \text{[iv]}$$

by [ii].

But [iii] is

$$\phi_b\left(\frac{\frac{T}{Q'_b}}{\lambda}, \ldots \frac{\frac{P}{Q'_b}}{\lambda}, \ldots \frac{\frac{K}{Q'_b}}{\lambda}, \ldots\right) = 0 . \qquad \text{[v]}$$

Comparing [v] with [i], and remembering that solution [ii] is unique, we get

$$\frac{Q'_b}{\lambda} = Q_b, \quad Q'_b = \lambda Q_b . \qquad \text{[vi]}$$

Substituting in [iv],

$$\lambda Q_b = F_b(\lambda T, \ldots \lambda P, \ldots \lambda K, \ldots) , \qquad \text{[vii]}$$

which is the definition of a homogeneous function of the first degree.

It will be observed that this proof is based on two assumptions: (1) that the partial derivatives of the Q_b-function are not zero, and (2) that ϕ_b is not a homogeneous function of b_t, $\ldots b_p, \ldots b_k, \ldots$. These restrictions are made in order to rule out cases of no solution for Q_b and cases of multiple solutions. They may be dispensed with, if we can assume that in practice cases of no solution do not arise or are unimportant, and if we can trust to the economics of the problem to enable us to select the economically significant solution of Q_b in cases of multiple solutions. But if we thus dispense with these restrictions, it

becomes more difficult to prove that Q_b is a homogeneous function of the first degree in $T, \ldots P, \ldots K, \ldots$.

It is worth observing that a homogeneous ϕ_b-function cannot arise in a concrete problem, for the reason that such a function has no economic meaning.

Consider, for example, the homogeneous equation

$$\frac{b_t}{b_k} - 1 = 0 . \qquad \text{[viii]}$$

By substituting T/Q_b for b_t and K/Q_b for b_k, this may be reduced to

$$T = K . \qquad \text{[ix]}$$

As Q_b, the quantity produced, does not appear in this equation, it is impossible to give it any meaning.

APPENDIX II

ERRORS AND CHANGES IN WALRAS' MARGINAL-PRODUCTIVITY THEORY

As was explained in note 4, page 508, above, Barone and Walras developed their marginal-productivity theory in 1894 and 1895, as a solution of the problem of variable coefficients of production. Walras included this solution in his "Note sur la réfutation de la théorie anglaise de fermage de M. Wicksteed," which was published in 1896, and reprinted this "note" in the third edition of his *Éléments*, which was published in the same year. In the fourth and definitive (1900) edition of the *Éléments*, Walras expanded his treatment of this subject, devoting the whole of the thirty-sixth "lesson" (pp. 371–84) to it.

Walras' treatment appears to contain several errors:

1. He apparently overlooks the fact that the equation connecting the compensatory coefficients of production and the equation of production must be two *different* functions. He writes both of them as

$$\phi\left(\frac{T}{Q}, \ldots \frac{P}{Q}, \ldots \frac{K}{Q}, \ldots\right) = 0$$

$$Q = \phi(T, \ldots P, \ldots K, \ldots) .$$

The second function, it is evident, must be different from the first. In this study it is written as

$$Q=F(T, \ldots P, \ldots K, \ldots).$$

This could hardly be a printer's error, for the same symbols were also used in the third (1896) edition. It is possible, however, as Professor Étienne Antonelli suggests, that Walras wished the two ϕ-functions to be understood as different functions ("les deux equations ... se trouvent dans deux raisonnements tout à fait différents").

2. Without explicitly assuming that F (Walras' ϕ) is a homogeneous function of the first degree, he writes (I am adopting his numbering for the equation):

$$Qp_b=Tp_t+Pp_p+Kp_k+ \ldots \qquad (1)$$

and

$$Q=\phi(T, P, K, \ldots), \qquad (2)$$

which correspond to equations [5] and [7] of this paper, and then says:

"Differentiant alors les equations (1) et (2) en vue du minimum de prix de revient, nous avons

$$\left(\frac{d\phi}{dT}\right)=\frac{p_t}{p_b}, \quad \left(\frac{d\phi}{dP}\right)=\frac{p_p}{p_b}, \quad \left(\frac{d\phi}{dK}\right)=\frac{p_k}{p_b}, \qquad (3)"$$

which corresponds to [12] of the text. (Derivatives in parentheses are partials.)

This reasoning appears faulty, as (3) does not follow from (1) and (2). The correct procedure is given on pp. 508–14, above. Reference to these pages will show that to obtain [12] (Walras' (3)) it was necessary to assume that the production equation [7] (Walras' (2)) is a homogeneous equation of the first degree in $T, P, K, \ldots$. Walras does not make this assumption. In fact, he deduces

$$Q=\left(\frac{d\phi}{dT}\right)T+\left(\frac{d\phi}{dP}\right)P+\left(\frac{d\phi}{dK}\right)+ \ldots, \qquad (4)$$

which is equation [8] (Euler's theorem on homogeneous functions) of the present study, from his equations (1) and (2).

All this is puzzling, since the fourth edition of the *Éléments* appeared in 1900, or three years after the publication of the second volume of Pareto's *Cours* in which the correct procedure is clearly shown (see *ibid.*, pp. 82 ff.). It could not be that Walras was ignorant of Pareto's solution of this problem, because Pareto communicated it to Walras before publishing it in his *Cours* (letter from Professor Pascal Boninsegni).

In 1896 Barone began the publication in the *Giornale degli Economisti* (February and March) of a study on distribution based on his and Walras' marginal-productivity theory. Pareto informed him of the error which he was making, and Barone interrupted this study (letter from Professor Boninsegni).

Pareto was also responsible for causing Wicksteed to abandon his marginal-productivity theory as expounded in the latter's *Essay on the Coördination of the Laws of Distribution* (1894). See Wicksteed's *Common Sense of Political Economy* (1910), p. 373, n. 1, wherein he refers to Pareto and Edgeworth.

Pareto's criticism of the marginal-productivity theory as given in the *Cours* is quite impersonal; it does not refer to Walras by name. However, in November, 1901, in a little book entitled *L'économie pure* ("Résumé du cours professé a l'École des Hautes Études Sociales à Paris," 1901–2) Pareto definitely referred to Walras' theory as "erroneous" and his equations (3) as "inadmissible," because "on y traite comme des variables indépendantes des quantités qui ne le sont pas." This led Walras to state his reasons for disagreeing with Pareto in a letter which he sent to Barone, and which I am able to publish herewith for the first time through the courtesy of Professor Étienne Antonelli, who sent me a copy of it.

Lieut.-Colonel BARONE, Professeur à l'École de Guerre, TURIN.

Les Bruvères sur Clarens, Vaud, Suisse.
10 Decembre 1901.

Monsieur le Colonel,

Dans une lettre du 20 septembre 1894 que j'ai sous les yeux, vous m'avez envoyé les équations de productivité marginale comme "équations de produit net maximum." J'ai trouvé les équations bonnes, mais incorrectement motivées.

Dans une note envoyée par vous à M. EDGEWORTH, par lui refusée, que M. PARETO m'a communiquée en octobre 1895, et dont j'ai également la traduction sous les yeux, vous fournissiez les mêmes équations comme "équations d'équilibre dans la distribution de tous les facteurs entre les diverses productions." Je vous ai écrit le 30 octobre que selon moi, elles étaient "équations du prix de revient minimum." Et vous m'avez répondu le 8 novembre que vous renonciez a votre avis pour vous ranger au mien.

J'ai tâché sincèrement de tenir un compte exact de toutes ces circonstances en introduisant dans la 4e édition de mes *Éléments d'économie politique pure*, le *Théorème des productivités marginales*.

Maintenant, dans une note (p. 10) d'un petit travail intitulé *L'économie pure* qu'il a publié récemment, M. PARETO dit ceci:

> Nous avons donné, *Cours* 719 note, les équations pour déterminer ces coefficients de fabrication.
>
> La théorie qui prétend les déterminer par la considération des productivités marginales est erronée. On y traite comme des variables indépendantes des quantités qui ne le sont pas, et les équations que l'on écrit pour déterminer le minimum ne sont pas admissibles. Telles sont les équations (3) des *Éléments d'économie politique pure* de M. WALRAS, 4e édition, p. 375.

En réponse à ces assertions, j'observe que, durant tout le cours des tâtonnements de la production, la quantité fabriquée du produit *(B)* $Q=\phi(T, P, K,)$ fixée d'abord, au hasard, à Q_b (*Éléments*, 208) puis successivement égale à $Q'_b \ldots$ (211), $D'_b \ldots$ (212), $D''_b \ldots$ (218), $D'''_b \ldots$ (219) [the numbers in the parentheses refer to paragraphs in the *Éléments*] est toujours déterminée d'une façon spéciale et constitue *une donnée* et non une *inconnue* du probléme de la détermination des coefficients de fabrication comme les prix des services et d'où il suit, ce me semble, que $T=Qb_t$, $P=Qb_p$, $K=Qb_k \ldots$ sont, dans ce dernier problème, des variables aussi indépendantes que le seraient b_t, b_p, $b_k \ldots$. Contrairement à l'opinion de M. PARETO, je persiste donc, en vertu de la conception du phénomène de l'établissement de l'équilibre économique qui est la mienne, à croire que les équations (3) de la p. 375 des *Éléments* sont parfaitement admissibles et que la théorie de la production marginale avec laquelle elles s'accordent est une théorie "capitale en économie politique pure" que vous avez eu le mérite de faire entrer rationnellement dans la science en fournissant l'expression mathématique la plus heureuse.

Je vous prie de me dire si la raison que je viens de vous donner vous semble bonne et si, en conséquence, vous êtes disposé à porter la responsabilité et selon moi, l'honneur des équations (1), (2), (3), et (4) de "détermination des coefficients de fabrication en vue du prix de revient minimum" telles que nous les posions d'un commun accord en 1895. Dans ce cas, mon n° 326 restera tel qu'il est, en ce qui vous concerne. Dans le cas contraire, je prendrai ces équations à mon compte.

Recevez, je vous prie, l'assurance de mes sentiments bien distingués.

Signé: LÉON WALRAS.

1° Note: J'ai attendu vainement une réponse de M. BARONE jusqu'au 6 mars 1902, jour où j'ai arrêté la correction des pp. 375–76 aux empreintes pour dictées de mes *Éléments*.

6 Mars 1902
Signé: LÉON WALRAS.

2° Note: Le 4 Octobre, rien encore; je porte les corrections à l'imprimerie.

L. W.

To understand Walras' argument it is first necessary to know what Pareto means when he says, in the passage quoted in this letter, that Walras' theory is erroneous, because "on y traite comme des variables indépendantes des quantités qui ne le sont pas ... ."

It is impossible, on the basis of this brief extract (I have not been able to locate a copy of the *L'économie pure*) to determine Pareto's meaning beyond a shadow of doubt. However, it seems reasonable to suppose that this sentence constitutes a translation, in mathematical terms, of his fundamental criticism of the marginal-productivity theory, which is discussed in section IV, pp. 517–18, above.

By the quantities which Walras treats as independent variables, Pareto understands the productive services $T, P, K, \ldots$.

For Walras' equations (3) (equations [12] of this paper)

$$\frac{\partial F_b}{\partial T}=\frac{p_t}{p_b}, \quad \frac{\partial F_b}{\partial P}=\frac{p_p}{p_b}, \quad \frac{\partial F_b}{\partial K}=\frac{p_k}{p_b}, \ldots \qquad [12]$$

to hold, the variations in the productive services must be independent of each other. This is possible when *all* the coefficients of production are variable and compensatory, i.e., when they are all connected by only *one* equation of the type

$$\phi_b(b_t, \ldots b_p, \ldots b_k, \ldots)=0\ ; \qquad [3]$$

for then it can be proved (see Appendix I) that [3] leads to a production function

$$Q_b=F_b(T, \ldots P, \ldots K, \ldots)\ , \qquad [7]$$

which is a homogeneous equation of the first degree in $T, \ldots P, \ldots K, \ldots$. In this equation the productive services $T, \ldots P, \ldots K, \ldots$ are independent variables.

An important property of this equation is that

$$Q_b=\frac{\partial F_b}{\partial T}T+\cdots+\frac{\partial F_b}{\partial P}P+\cdots+\frac{\partial F_b}{\partial K}K+\cdots, \qquad [8]$$

which property is necessary for the deduction of [12]. See pp. 513, and 543–44, above.

Suppose, however, that one of the coefficients of production is constant, or, more generally, that the coefficients are connected by more than one functional relation—say, the following:

$$\phi_1(b_t, b_p, \ldots)=0$$
$$\phi_2(b_k, b_m, \ldots)=0.$$

From these we can deduce

$$Q_b=F_1(T, P, \ldots)$$
$$Q_b=F_2(K, M, \ldots),$$

where F_1 is a homogeneous equation of the first degree in $T, P, \ldots$, and F_2 is a homogeneous equation of the first degree in $K, M, \ldots$.

Since both functions are equal to one and the same Q_b, there *must* exist some relation between the variables (productive services) $T, P, \ldots$ and the variables $K, M, \ldots$. Therefore, the partial derivative of Q_b with respect to any variable—say, T—i.e., $\frac{\partial Q_b}{\partial T}$, is meaningless, unless we specify which variables we are to consider as independent, since T might be a function of M. It is true, of course, that

$$Q_b=\frac{\partial F_1}{\partial T}T+\frac{\partial F_1}{\partial P}P+\ldots,$$

where F_1 is the function given above. But the equation

$$Q_b=\frac{\partial Q_b}{\partial T}T+\frac{\partial Q_b}{\partial P}P+\ldots$$

is meaningless, and without this equation it is impossible to deduce Walras' equation (3).

Walras' reply to Pareto's criticism that the productive services must not be treated as independent variables is that the production function is always determined in a special manner, constituting a given element in the problem, and that, therefore, T, P, K, . . . are as independent as b_1, b_2, b_3 . . . .

This reply is not convincing. Either *all* the coefficients are compensatory and are connected by only *one* functional relationship or they are not. In the first case the productive services may vary independently of one another, and the marginal-productivity theory holds. In the second case the marginal-productivity theory fails.

That Walras was troubled by Pareto's criticism is evident from the fact that he omitted his equation (4) (Euler's theorem) when he revised his *Éléments* in 1902. But the reader is not even informed of this very important omission. It is probable, however, that Walras' position will appear in a clearer light when his abridgment of his *Éléments* and his scientific papers are published (letter from Professor Antonelli).

HENRY SCHULTZ

UNIVERSITY OF CHICAGO

THE STANDARD OF LIVING AT THE PROFESSIONAL LEVEL, 1816–17 AND 1926–27

JUST over a hundred years ago a gentleman of Washington, D.C., Mr. E. L. Jackson,[1] kept from October 1, 1816, to September 30, 1817, a careful and detailed record of all his expenditures.[2] He was a young man employed in a responsible position in the office of the secretary of one of the government departments. According to the official record, his salary was $1,000 a year, or in the words of the record, $250 a quarter. It is not possible to point to any one man as holding the identical position in the much larger organization of today, but the men in similar positions are receiving from $2,700 to $3,100 a year. The chief clerk in the office, now paid $5,200, was then on the rolls at $2,000. Mr. Jackson in 1833 was appointed to an important post at a salary of $2,500. The same post today pays $6,500. These figures will give some idea of the relationship between the government salaries of 1816–17 and those of 1926–27.

Mr. Jackson had a wife and a daughter, Mary, a child about five years of age. A young man boarded in the family, and it is likely that there was a full-time maid since on the 20th of each month the entry, "wages for Violet," always appears. The Jacksons were connected with St. John's Episcopal Church and were people of good social position. Judging from the expenditures, the family had some income in addition to the salary and the money received from the boarder.

One hundred and ten years later, among a number of Washington, D.C., families who were keeping day-by-day records of expenditures for the United States Bureau of Home Economics, there was one, the Nixons, remarkably similar to the Jackson family. The husband was employed by the government in a

[1] Names are fictitious.

[2] This account-book is now in the possession of Dr. C. F. Langworthy, of the Bureau of Home Economics, United States Department of Agriculture, who kindly drew the attention of the writer to its possibilities and permitted its use in this study. He also supplied certain social data concerning the family.

professional position at a salary of $3,000 a year. He had a wife and two children, a son of three and an infant daughter four months old, when the accounts were begun, October, 1926. A young man, a college student, lived with the family, and there was also a maid, so that the size of the household was much like that of the Jacksons. Socially as well as professionally the families were in much the same position. From an educational point of view there was, of course, a difference. The young man of 1926 was a Ph.D., and his wife a college graduate. In 1816 it was the husband who was keeping the accounts and apparently guiding the details of the household, whereas in 1926 it was the wife. Before her marriage she had been professionally employed and making a good salary. She still contributed a little to the family income as the opportunity offered. The family also had $720 a year from investments.

With two families so much alike in size and in professional and social position, the questions which immediately come to mind are: How different is their standard of living? How much has the cost of living changed? What differences are there in commodities purchased? Has the standard of living risen and in what particulars? Do the men today in positions like that held by the account-keeper of 1816–17 live better than he did? Are they receiving more in real income, as well as in money?

There are no index numbers for retail prices going back as far as 1816, but with a recognition of the limitations and with no attempt at a too-exact comparison of one year with another, the index numbers for wholesale prices covering the period in question may be used to give a general indication of the way in which prices have changed. According to the series developed by Mr. Hurlin,[2] the trend of prices since 1810, when his series begins, has been downward. As he points out, all attempts to construct long-time index numbers of commodity prices have shown prices to have had this definite downward direction.

The trend of prices downward is contrary to the somewhat common opinion that with the development of the country commodities have on the whole become dearer. Mr. Hurlin suggests

[2] R. G. Hurlin, "The Long Time Trend of Prices in the United States." *Annalist*, xvii (April 11, 1921), 425, and (July 4, 1921), 707.

that, since the index for foods has declined less than that for all commodities while those for metals and for clothing and clothing materials have declined more, in a large measure the declining price level has been the result of improvements which have progressively increased the amount of production while lessening its cost, and that commodities have declined in price in spite of the constantly increasing demand occasioned by the growth of population and by the increase in the amount of money in circulation per capita.

The Senate Foreign Currency and Exchange Investigation[4] compiled an index number covering the period 1791–1924, using much the same basic data as did Mr. Hurlin.

The Hurlin series on a 1914 base shows a decline in the wholesale price index number from the peak of 167 in 1814 to 99 in 1833; then a rise to 125 in 1836; down to 84 in 1843; a steady upward trend to 1864 when it reached 237; then down to 67 in 1895 and 1896; then up to 100 in 1914, and to 244 during the 1920 peak. Continuing the series, the index numbers for 1926 and 1927 are approximately 148 and 144. The Foreign Currency and Exchange Investigation index series on a 1913 base show much the same trend.

The separate series given by Mr. Hurlin for food and for clothing and clothing materials are interesting from the standard of living point of view. Food shows a peak in 1814 reaching 219. In 1816 the food index number was 173; in 1817, 196; in 1920, 229; in 1926, 156, and in 1927, 152. The index number for clothing and clothing materials in 1814 was 234; in 1816, 185; in 1817, 176; in 1920, 308; in 1926, 172, and in 1927, 168.

Thus, according to both index series 1814 and 1920 were peak years. The wholesale price index numbers for 1816 and 1817 show much the same relation to the peak of 1814 as do those of 1926 and 1927 to the peak of 1920, and in relation to the base years both index series show wholesale prices for all commodities, for food, and for clothing and clothing materials, in 1816 somewhat higher than those in 1926–27. Specifically,

[4] *Commission of Gold and Silver Inquiry: U. S. Senate Foreign Currency and Exchange Investigation*, Serial 9 (Washington: Government Printing Office, 1925), I, 436, and chart 3 opposite p. 71.

according to the Hurlin index for all commodities the index numbers for 1816 and 1817 were 165 and 167, and for 1926 and 1927, 148 and 144.

Of course, in comparing the index numbers of the two periods for the purposes of this study, it must be remembered that they deal with wholesale prices in general, and not only do different commodities vary in price differently but retail and wholesale prices do not move regularly one with the other. However, they show the same trend. For example, Dr. King's new index number, representing retail prices for the country as a whole, shows that the retail price level rose far less than the wholesale price level during the inflation of 1920, and consequently did not descend so far in 1921, but still both wholesale and retail prices reached the high level in 1920 and have followed the same general trend.[6] The weights for a cost of living index number would differ from one for all retail, and still more from one for all wholesale, prices, but the index numbers presented are useful as serving to give a rough approximation of the tendency toward a decline in prices over the hundred and ten years between the 1816–17 account-book of the Jacksons and the 1926–27 record of the Nixons. Briefly stated, for commodities worth $1.00 (at wholesale) in 1914 one would have paid $1.65 in 1816, and $1.48 in 1926. Probably the difference between retail prices at the two dates would be somewhat less. Because of this and the approximate nature of the index numbers when applied to cost-of-living data, no attempt has been made to reduce the expenditures of the two families to a common base.

The expenditures of the two families can be compared by listing in parallel columns the things purchased and the amounts spent for each class of items. It will be remembered that the families were almost identical in size, in the type of occupation and position, and in social status, and were living in the same community. What difference did one hundred and ten years make in the way in which their money was spent, and in the level of living which they were able to maintain?

[6] See *News-Bulletin* (National Bureau of Economic Research, Inc.), September 10, 1928, p. 4; U.S. Bureau of Labor Statistics, Bulletin No. 445, *Retail Prices, 1890 to 1926*, and Bulletin No. 440, *Wholesale Prices, 1890 to 1926*.

TABLE I

EXPENDITURES OF A PROFESSIONAL FAMILY IN 1816–17 COMPARED WITH THOSE OF A SIMILAR FAMILY IN 1926–27

ITEMS PURCHASED	NIXON, 1926–27		JACKSON, 1816–17	
	Dollars	Percentage of Total Expenditures	Dollars	Percentage of Total Expenditures
Food, purchased	824.89	17.0	916.35	46.1
Meals out	16.05	0.3	.....	.....
Husband's lunches	73.50	1.5	.....	.....
Total food	914.44	18.8	916.35	46.1
Clothing, general supplies	3.37	0.1	0.96	0.05
Husband	202.80	4.8	82.65	4.2
Wife	266.98	5.5	14.37*	0.7
Son	71.67	1.5	.....	.....
Daughter	59.49	1.2	8.06*	0.4
Total clothing	604.31	12.5	106.04	5.3
Housing, repairs	1.00	0.02	3.68	0.2
Taxes on house	290.88	6.00	.....	.....
6 per cent on equity, or rent	960.00	19.8	187.50 (rent)	9.4
Total housing	1,241.88	25.8	191.18	9.6
Operating, fuel	129.45	2.7	80.51	4.1
Light and power	52.64	1.1	13.04	0.7
Water	10.60	0.2	.....	.....
Telephone	34.98	0.7	.....	.....
Ice	33.00	0.7	0.25	0.01
Household supplies	25.84	0.5	10.78	0.5
Laundry	26.60	0.5	.....	.....
Service	373.34	7.7	39.22	2.0
Stationery, postage, etc	15.90	0.3	17.67	0.9
Carfare	4.80	0.1	1.37	0.1
Total operating	707.15	14.6	162.84	8.2
Health, general	3.02	0.1	6.95	0.3
Wife	38.00	0.8	.....	.....
Son	77.53	1.6	.....	.....
Total health	118.55	2.4	6.95	0.3
Development, reading	47.28	1.1	.....	.....
Church	4.40	0.1	.....	.....
Charity	1.00	0.02	0.40	0.02
Personal taxes	10.45	0.2	.....	.....
Gifts	71.93	1.5	3.26	0.2
Recreation	24.20	0.5	11.75	0.6
Recreation equipment	36.47	0.8	.....	.....
Vacation trips	102.00	2.1	12.25	0.6
Vocation	69.50	1.4	1.50	0.1
Associations, not vocational	2.00	0.04	.....	.....
Children's equipment	48.30	1.10	8.56	0.4
Entertaining	9.55	0.2	.....	.....
Formal education	.....	.....	7.25	0.4
Total development	427.08	8.8	44.97	2.3

TABLE I—*Continued*

Items Purchased	Nixon, 1926–27		Jackson, 1816–17	
	Dollars	Percentage of Total Expenditures	Dollars	Percentage of Total Expenditures
Furnishings and equipment	88.08	1.8	367.30	18.5
Personal, general	21.03	0.4	.....	.....
Husband	20.80	0.4	22.71	1.1
Wife	13.60	0.3	97.84*	4.9
Son	1.50	0.03	.....	.....
Daughter	1.48	0.03	.....	.....
Total personal	58.41	1.2	120.55	6.1
Automobile	166.18	3.4	.....	.....
Life insurance	292.15	6.0	.....	.....
Savings	225.60	4.6	.....	.....
Miscellaneous	.....	.....	70.47†	3.6
Total expenditures	4,853.83	100.0	1,986.65	100.0

* Items listed under clothing were itemized. Under personal are included all entries of "Mrs. J.," so much. A large part of the total amount so entered must have been spent for clothes for Mrs. Jackson and for Mary.

† Paid on a bill for unidentified items, probably purchased before the account-book was started.

Now, how do these expenditures differ? Of course, the total for 1926–27 is almost two and a half times as great as the total for 1816–17. This corresponds quite well with the increase in salaries, but the differences in percentage of total spent for certain items is the point of greater interest. For example, the amount spent for food is almost identical in the two families. Remembering that their makeup as to number of persons, sex, and age is practically the same, this is of particular value. But in the case of the Jackson family the expenditure for food constituted 46.1 per cent of the total, while for the Nixons it was only 18.8 per cent. Of course, it is well recognized that the percentage of income spent for food is one of the most effective indicators of the level of living. When the level is low, the percentage spent on food is high. For example, in the 1918–19 study of 12,096 working-class families, made by the United States Bureau of Labor Statistics, the percentage spent on food averaged 38.2 per cent, but varied from 44.1 per cent for families with incomes under $900 to 34.6 per cent for families with incomes between $2,100 and $2,500. The same point is illustrated in the budgets devel-

oped by the California State Civil Service Commission in 1921. For the family of a laborer with an income of $2,157, 32.3 per cent was set aside for food; for the family of a clerk with $3,149, 25.3 per cent; while for the family of an executive with $7,034, only 15.1 per cent was allowed for this item. This decrease in the percentage expenditure for food from 46.1 per cent in 1816–17 to 18.8 per cent in 1926–27 is one indication of the rise in the professional level of living between the two dates. The family in 1816 was spending a higher percentage for food than did the present-day families of unskilled laborers in Chicago studied by Miss Houghteling.[6] Their average expenditure for food was 38.8 per cent. None of her groups, not even the lowest, with less than $1,200 a year, spent more than 42.8 per cent of the family income on food. In 1922, among a group of ninety-six faculty families in Berkeley, California, 16.2 per cent of the total expenditures went for food.[7] Other studies being made by the Bureau of Home Economics indicate this as a typical figure for professional families, so that the Nixon family can be taken as representative of this group. Unfortunately, other studies of family expenditures in 1816–17 are not available for comparison with those of the Jacksons.

The percentages spent on items under the general heading of development show, as one would expect, a situation opposite to that for food. The family in 1816–17 listed no expenditures for reading matter beyond a few books for the child. Neither family spent much for church or charity; in fact, Mr. Jackson had no expenditures under church, but a memorandum under date of July 26, 1817, notes that he had agreed to pay $30 for a pew in the South Gallery, St. John's church. For both families the theater was the chief item under the heading of recreation. The Jacksons spent just half as much for this as did the Nixons. They went six times during the year, on four occasions Mr. Jackson apparently going alone as only one ticket was purchased.

[6] Leila Houghteling, *The Income and Standard of Living of Unskilled Laborers in Chicago*. (Chicago: University of Chicago Press, 1927), p. 94, Table LII.

[7] J. B. Peixotto, *Getting and Spending at the Professional Standard of Living* (New York: Macmillan Co., 1927), p. 123.

One of these was for "Mr. Burke's Benefit," costing $3.25, the most expensive evening listed. The Nixons made fifteen visits to the movies or the theater. The Jacksons bought nothing which could be listed under recreational equipment. Under this head the $36.47 spent by the Nixons covered chiefly expenditures in connection with their radio plus a few dollars on films and developing films. There is no evidence that, beyond a trip to Little Falls, a few miles up the Potomac, the Jacksons had any vacation trips, while this item accounted for $102 in the Nixon budget. "Entertaining" listed in the Nixon budget refers to expenditures for guests other than meals in the home. There were no equivalent expenditures in 1816–17.

Under vocational expenditures Mr. Nixon included membership in two professional associations, and a trip to Philadelphia to attend the annual meeting of one of them. The $1.50 in 1816–17 was for printing, which may not have been entirely a vocational expenditure.

Neither of the Nixon children was old enough to attend school. Mary Jackson in 1816 was apparently being given some lessons, as there is one item of $4 for "Mary's tuition." The balance under formal education is for books which were bought, a spelling-book and a geography. The children's equipment purchased by the Nixons was chiefly for the three-year-old boy, as the baby was very young and the toys bought for her were inexpensive. This family spent $48.30 on toys, including an auto at $13.50, a train at $3.50, sled at $4.75, and a set of Lincoln logs at $4.00, besides a number of less expensive articles. Of the $8.56 listed for Mary Jackson, $8.00 was for a cradle bed, 43½ cents for three little books, and 12½ cents for a toy.

It seems likely that the Jacksons were furnishing their house, as the outlay for furniture and furnishings amounts to 18.5 per cent of the total expenditures. Some of the items listed were a gilt frame, $7.50; a chamber fire set, $5.00; a fender, $6.50; bedstead, $17.00; set of chairs, $42.00; also a portrait of the head of the house by Wood, costing $34.00. Bed and table linen came to $63.22, kitchen ware to $23.47, silver and table china to $46.50. Among the items of silver were a wine cooler at $4.00, a

ladle at $6.50, and plated coasters at $7.00. The kitchen equipment included four brooms at 18¾ cents each, a clotheshorse at $3.00, tin bucket at $1.25, coffeepot at 75 cents, collander at 75 cents, teakettle at $3.50, and a waffle iron at $2.50. A hoe cost $1.00, and a rake 75 cents.

The Nixons spent a much smaller amount for furnishings and equipment, and a very much lower percentage of their total income went into these items. But they already had a well-furnished house, having furniture and equipment valued at $3,000.00, and most of the $88.00 spent during the account-year went for flowering plants for the house, the only large item in permanent equipment being the very modern one of $16.95 for aluminum cooking utensils.

Operating expenses are very different for the two families, the Nixons spending $707.15, or 14.6 per cent of their income, as against the $162.84, or 8.2 per cent, spent by the Jacksons. There is also a great difference in the items represented. Apparently the Jacksons had a woman working as a full-time maid. They also had other women in from time to time and the item "washwoman—50 cents" appears occasionally. The total for service and for laundry which was all done at home came to $39.22, or 2 per cent of the income, as against the $399.94, or 8.2 per cent, spent by the Nixons for service and laundry. During the year the Jacksons paid the regular maid $2.00 a month, or $24.00 for the year; and day help, $15.22. The Nixons employed a maid full time for thirty-nine weeks at rates varying from $7.00 to $10.00 per week, amounting in all to $342.00. A laundress for seven weeks cost $26.00, occasional day-workers $5.96, and laundry sent out $26.60. The amount of service available to the two families was apparently about the same, but the wages paid were of course very much higher in 1926–27 than in 1816–17.

Many of the items under operating in the Nixon list are either absent in that of the Jacksons or represented by an entirely different type of article. The telephone of 1926 has no counterpart at the earlier date. Ice, an item of $33.00 in 1926–27, appears only once in 1817, at 25 cents when the Jacksons

were having a party in July. In Table I carfare in 1816–17 refers to two occasions upon which a hack was employed. Light for 1816–17 meant candles; in 1926–27, electricity, which was used not only for lighting but for power, for the Nixons had an electrically run washing machine, vacuum cleaner, iron, curling iron, waffle iron, toaster, chafing dish, percolator, sewing machine, and radio charger. Instead of the flickering, if charming, candlelight, their house was well fitted with electric table lamps as well as the regular fixtures. Household supplies in 1926–27 were more than twice the amount of 1816–17, when they consisted only of soap, starch, and bluing.

Fuel was, in terms of percentages, a more important item in 1816–17 than in 1926–27, though in the latter case it represented a furnace-heated house with a coal bill of $62.00, and gas for cooking and for heating water which cost $67.45, and in the former, wood costing $80.51. In 1816–17 this fuel item came to 4.1 per cent of the total income, while in 1926–27 it was 2.7 per cent. While the account-book gives no statement of exact quantities, there are entries which indicate that Mr. Jackson paid around $3.50 a cord for the wood including cutting.

Health in 1816–17 included two items for doctor, one at $1.00 and one at $3.50. The balance was for medicine, mostly "patent," 50 cents for example being paid for worm lozenges and 50 cents for Lee's anti-bilious pills. There were no dentist bills, no routine examination by child specialists, which account for most of the $118.55 spent on health in 1926–27. There was no serious illness in the Nixon family, but the little boy had to have attention and Mrs. Nixon had some dental work done. The family is of the type which feels that health is an important item to be cared for regularly though they do not spend needlessly.

It is not possible to compare in detail the housing items, as there is no description of the house which was rented in 1816–17. However, judging by the furniture bought, it must have been a good house of some pretensions. Still, the Jacksons spent only 9.6 per cent of their income for "housing," as against 25.82 per cent spent by the Nixons in 1926–27. The Nixons lived in a house valued at $16,000.00. It is located in a good section not

very far out, has nine rooms and two baths. The plumbing, the furnace, the electric lights, the hardwood floors, the many built-in conveniences were all lacking in the house of 1816–17. In 1926–27 the family was paying more for housing, both absolutely and in relation to other items in the budget, than in 1816–17, but was also getting much more in the way of comfort, sanitation, and convenience. Six per cent of the total expenditure was for taxes which provide the water piped to the door, the excellent sewerage system, the good streets, the street lighting, and all the other municipal conveniences which Washington in 1816 could not provide. But, even without taxes, the item for housing was much larger, both absolutely and relatively, in 1926–27 than in 1816–17. The increase in the standard of living as regards housing is too obvious for comment; while the great increase in land values accounts for part of the increase in housing expenditures, it is far from accounting for all.

The automobile, of course, appeared only in 1926–27. There are no savings in 1816–17. The 10.6 per cent of total expenditures saved by the Nixons has no counterpart in the account-book of 1816–17. Mr. Jackson entered all his transactions in the book, such as sums lent, etc., so that it seems very likely that, had he invested, note would have been made of that fact. A comparison of his salary with total expenditures would also justify the belief that he had no savings.

There is some difficulty in comparing the expenditures of the two families for clothing and for personal items. In the case of the Nixons the accounts were kept in such a way that it is very clear just how much was spent for clothes and how much for personal items such as toilet supplies, haircuts, etc., for each member of the family, but in 1816–17 amounts totaling $97.84 were entered simply as "Mrs. J." It seems likely that much of this was spent for clothing for Mrs. Jackson and Mary, though some of it may have gone for personal items. The expenditures for the two men may, however, be compared in detail, as Mr. Jackson listed his clothing item by item and likewise his personal expenditures. Under personal he spent $22.71, which included as principal items four visits to the barber at 25 cents each, $1.25 for

the bootblack, and $19.97 for cigars for which he apparently paid 6¼ cents apiece as a rule. Mr. Nixon spent $20.80 for personal items, but since he does not smoke most of this went into personal equipment, such as a traveling bag. No entries were made which could be specifically classified as personal expenditures for Mrs. Jackson. Mrs. Nixon's personal expenditures, $13.60, practically all went for haircuts, marcels, and cold creams.

The Nixons spent $21.03 for personal items for the family as a whole, that is for toilet soap, toothpaste, etc., and for candy and sodas, the last two items accounting for $13.89. There were no special items of this nature listed in 1816–17, except 31 cents spent by Mr. Jackson for shaving soap.

Clothes in the case of the Nixons cost $604.31, or 12.5 per cent of total expenditures. For the Jacksons as itemized they amounted to $106.04, or 5.3 per cent, or including the $97.84 given to Mrs. Jackson and not itemized, to $203.89, or 10.2 per cent of total expenditures. In the case of the Nixons the wife and the children together spent for clothes $398.14, or 8.2 per cent of the total family expenditures; while Mrs. Jackson and Mary at the maximum spent $120.27, or 6 per cent.

The two husbands spent almost the same percentage of the total family expenditure for clothing, Mr. Nixon $202.80, or 4.8 per cent, Mr. Jackson $82.65, or 4.2 per cent. The items and the prices paid are interesting and somewhat surprising, as so much likeness is apparent in certain items and such difference in others.

The items bought by Mr. Nixon are listed in Table II.

TABLE II

CLOTHING OF HUSBAND—1926

Repair shoes	$ 2.25	Cuff links	$ 0.65
2 pairs shoes	24.00	Gloves	4.50
Coat	31.75	Garters	0.50
Trousers	3.00	Collars	5.00
Suit	25.00	Ties	14.00
Suit	25.00	Sox	4.47
Knickers	2.85	Union suits	12.00
Pressing and cleaning	28.00	B.V.D.	1.98
Scarf	2.85	Shirts (5)	15.00

It is not possible to make a parallel list for Mr. Jackson, as he bought material and did not always note for what garment it was used. A coat at $28.75 was the largest item and corresponds most interestingly with the coat Mr. Nixon bought for $31.75. Shoes were very much cheaper in 1816–17 than in 1926–27. Mr. Jackson had two pairs, one at $2.00 and one at $3.00, besides an item for "footing boots," $4.00. He paid $10.00 for a hat, $4.25 for white handkerchiefs, $12.87 for cloth for shirts, and $3.50 for a vest pattern; also, $2.00 for suspenders, and $5.00 for hose, apparently at $1.00 a pair. He also paid $4.00 for making the shirts, but unfortunately does not state the number. There is no equivalent to the $28.00 for pressing and cleaning found on the Nixon list, nor for the ties.

Among the clothing specifically mentioned for Mrs. Jackson were a pair of shoes at $2.50, and another at $1.00. Mrs. Nixon paid $9.90 for one pair of shoes, and bought two other pairs for $16.45 for the two. Mrs. Jackson paid $1.50 for a pair of "factory hose." Mrs. Nixon bought silk stockings only, listing six pairs for the year costing $7.45. For Mary Jackson there was specifically mentioned a cap at $3.00, cord and tassel at $3.00, and a pair of shoes at $1.25. The little Nixon boy's shoes cost $3.00 a pair, and he had two pairs besides one pair of play shoes at $1.00. There is no doubt that many articles of clothing were more costly and that a greater number and variety of garments were bought for each member of the family in 1926–27 than was the case in 1816–17.

Both families kept their food accounts in great detail. While the Jacksons did not always list quantities, still they did list items and total amount paid. The complete list of the things which the two families ate and the cost can therefore be given in Table III.

While each family spent almost exactly the same number of dollars on food, the distribution among the various items shows interesting differences, as can be seen by running down the two lists. The Jacksons spent more for butter than did the Nixons, $77.48 as compared with $63.11; but the reverse is true of milk, the bill in 1816–17 being only $24.70 as against $184.48 in 1926–

TABLE III

FOOD EXPENDITURES OF A PROFESSIONAL FAMILY IN 1816–17 AND OF A SIMILAR FAMILY IN 1926–27

ITEMS	NIXONS, 1926–27			JACKSONS, 1816–17		
	Dollars	Percentage of Total Food Expenditure	Percentage of Subtotal	Dollars	Percentage of Total Food Expenditure	Percentage of Subtotal
Milk	184.48	20.2	.....	24.70	2.7	.....
Cream	1.77	0.2	.....	.....	.....	.....
Ice-cream	18.73	2.0	.....	3.75	0.4	.....
Butter	63.11	6.9	.....	77.49	8.4	.....
Eggs	46.02	4.6	.....	43.79	4.8	.....
Cheese	1.60	0.2	.....	0.56	0.1	.....
All meat	99.91	10.9	100.0	249.94	27.3	100.0
Beef	47.86	5.2	47.9	85.30	9.3	34.1
Dried beef	1.85	0.2	1.8	.....	.....	.....
Pork	14.35	1.6	14.4	15.22	1.7	6.1
Sausage	.....	.....	.....	4.18	0.4	1.7
Ham	14.63	1.6	14.6	.....	.....	.....
Bacon	10.31	1.1	10.3	69.29	7.6	27.7
Veal	1.95	0.2	2.0	36.48	4.0	14.6
Lamb	7.51	0.8	7.5	29.40	3.2	11.8
Mutton	.....	.....	.....	10.07	1.1	4.0
Other meat	1.45	0.2	1.5	.....	.....	.....
Poultry	50.15	5.6	.....	59.70	6.5	.....
Fish	11.68	1.3	.....	12.42	1.35	.....
Oysters	.....	.....	.....	11.08	1.2	.....
Lard	0.50	0.1	.....	6.38	0.7	.....
Lard substitutes	10.66	1.2	.....	.....	.....	.....
Oils	4.79	0.5	.....	.....	.....	.....
All cereals	48.22	5.5	100.0	149.53	16.3	100.0
White flour	0.73	0.2	3.6	103.67	11.3	69.3
Other flour	3.27	0.4	6.8	1.56	0.2	1.1
Oatmeal	0.35	0.03	0.7	.....	.....	.....
Breakfast foods	7.03	0.8	14.6	.....	.....	.....
Rice	1.72	0.2	3.6	0.80	0.1	0.5
Hominy	.....	.....	.....	3.78	0.4	2.5
Cornmeal	0.43	0.04	0.9	11.91	1.3	8.0
Tapioca	0.37	0.04	0.7	.....	.....	.....
Macaroni	0.55	0.1	1.1	.....	.....	.....
Cornstarch	1.00	0.2	2.1	.....	.....	.....
Crackers	5.68	0.6	11.8	2.75	0.3	1.9
Cookies and cakes	6.32	0.7	13.1	14.71	1.6	9.8
Bread	19.77	2.2	41.0	10.35	1.1	6.9
All sweets	40.59	4.4	.....	61.03	6.7	.....
Sugar	25.45	2.7	.....	57.91	6.3	.....
Sirup and molasses	1.06	0.1	.....	2.38	0.3	.....
Honey	1.60	0.2	.....	.....	.....	.....
Jams, jellies, etc.	12.48	1.4	.....	0.75	0.1	.....

TABLE III—*Continued*

Items	Nixons, 1926–27			Jacksons, 1816–17		
	Dollars	Percentage of Total Food Expenditure	Percentage of Subtotal	Dollars	Percentage of Total Food Expenditure	Percentage of Subtotal
All potatoes	24.76	2.7	100.0	19.68	2.2	100.0
Irish potatoes	20.08	2.2	81.1	14.94	1.6	75.9
Sweet potatoes	3.78	0.4	15.3	4.74	0.5	24.1
Potato chips	0.90	0.1	3.6	.....	.....	.....
All vegetables	91.44	10.1	100.0	38.99	4.4	100.0
Root:						
Carrots	5.37	0.6	5.9	2.59	0.3	6.6
Turnips	1.00	0.2	1.1	2.48	0.3	6.4
Parsnips	0.15	.....	0.2	1.00	0.1	2.6
Beets	0.70	0.1	0.8	1.78	0.2	4.6
Green onions	0.19	.....	0.2	.....	.....	.....
Dry onions	2.54	0.3	2.8	1.58	0.2	4.1
Legumes:						
Lima beans	0.65	0.1	0.7	.....	.....	.....
Dried beans	0.24	.....	0.3	.....	.....	.....
Fresh peas	3.84	0.4	4.2	3.62	0.4	9.3
Corn	3.03	0.3	3.3	0.65	0.1	1.6
Leafy:						
Cabbage	1.98	0.2	2.2	5.91	0.6	15.2
Lettuce	13.28	1.5	14.5	.....	.....	.....
Spinach	6.99	0.8	7.6	2.51	0.3	6.4
Greens	.....	.....	.....	1.56	0.2	4.0
Cauliflower	2.25	0.2	2.5	.....	.....	.....
Celery	3.12	0.34	3.4	0.31	.....	0.8
Other:						
Tomatoes	10.91	1.2	11.9	2.55	0.3	6.5
Asparagus	0.65	0.1	0.7	2.66	0.3	6.8
Cucumbers and radishes	0.68	0.1	0.7	2.50	0.3	6.4
String beans	9.83	1.1	10.7	4.45	0.5	11.4
Squash	1.05	0.2	1.1	2.86	0.3	7.3
Pumpkin	0.45	.....	0.5	.....	.....	.....
Peppers	0.38	.....	0.4	.....	.....	.....
Other vegetables	0.80	0.1	0.9	.....	.....	.....
Canned vegetables	21.36	2.3	23.4	.....	.....	.....
All fruit	96.20	10.5	100.0	23.22	2.6	100.0
Apples	12.42	1.4	12.9	5.31	0.6	22.9
Bananas	3.22	0.4	3.3	.....	.....	.....
Berries	15.50	1.7	16.1	6.91	0.8	29.7
Cherries	5.25	0.6	5.6	1.32	0.1	5.7
Grapefruit	1.80	0.2	1.9	.....	.....	.....
Grapes	2.18	0.2	2.3	3.00	0.3	12.9
Lemons	0.33	.....	0.3	2.50	0.3	10.8
Oranges	22.16	2.4	23.0	.....	.....	.....
Peaches	5.85	0.6	6.1	2.23	0.2	9.6
Pears	0.25	.....	0.2	.....	.....	.....
Pineapple	0.30	.....	0.3	.....	.....	.....
Plums	.....	.....	.....	1.44	0.2	6.2

TABLE III—*Continued*

Items	Nixons, 1926–27			Jacksons, 1816–17		
	Dollars	Percentage of Total Food Expenditure	Percentage of Subtotal	Dollars	Percentage of Total Food Expenditure	Percentage of Subtotal
Watermelon	1.80	0.2	1.9	.....	.....	.....
Other fruit	1.55	0.2	1.6	0.51	0.1	2.2
Canned fruit	23.59	2.6	24.5	.....	.....	.....
Dates	1.20	0.1	.....	.....	.....	.....
Dried apples	.....	.....	.....	0.63	0.1	.....
Figs	.....	.....	.....	1.58	0.2	.....
Prunes	1.63	0.2	.....	.....	.....	.....
Currants	.....	.....	.....	0.50	.....	.....
Raisins	0.56	0.1	.....	10.19	1.1	.....
Miscellaneous foods:						
Soup	0.59	0.1	.....	.....	.....	.....
Chocolate and cocoa	2.32	0.3	.....	.....	.....	.....
Nuts	7.31	0.8	.....	7.15	0.8	.....
Gelatin	0.79	0.1	.....	.....	.....	.....
Coffee	4.51	0.5	.....	18.00	2.0	.....
Tea	0.25	.....	.....	12.27	1.3	.....
Spices	0.35	.....	.....	3.70	0.4	.....
Pickles	0.45	.....	.....	0.63	0.1	.....
Vinegar	0.83	0.1	.....	1.44	0.1	.....
Salt	0.48	0.1	.....	2.29	0.2	.....
Extracts	1.71	0.2	.....	.....	.....	.....
Popcorn	0.60	0.1	.....	.....	.....	.....
Alcoholic beverages	.....	.....	.....	75.25	8.2	.....
Soda, etc	6.70	0.5	.....	0.50	.....	.....
Meals out	89.55	9.8	.....	.....	.....	.....
Total food	914.44	100.0	.....	916.40	100.0	.....

27. The price paid for milk in 1816–17 is not given, but in November, 1816, butter was 43¾ cents a pound, and in 1926 from 55 to 60 cents. Assuming a similar increase in the price of milk and allowing for the presence of a baby in 1926–27, this apparently shows a change in milk consumption habits, while the amount of butter used by the two families was about the same. The two families spent almost the same amount for eggs. In the fall of 1816 they were bought at 37½ and at 45 cents a dozen, and later on in the winter at 50 cents; while at corresponding months in 1926–27 the price was from 55 to 75 cents a dozen, showing that fewer were used in 1926–27 than in 1816–17.

Again, there was not much difference in the amount spent for

poultry, but prices indicate that this meant much more in quantity in 1816–17 than in 1926–27. In the 1816–17 account-book, turkey is listed eight times during the year, at from $1.00 to $1.50 each. A goose cost from 75 cents to $1.00. The Nixons had one goose costing $3.70, and one turkey costing $5.73. Since the families were so similar in makeup, it is likely that the birds were somewhat comparable in size. A pair of fowl in 1816 was entered at 76 cents, while Mrs. Nixon paid from $1.25 to $1.70 for one.

Meat accounted for $249.90, or 27.3 per cent of the total food expenditure in 1816–17, as against $99.91, or 10.9 per cent in 1926–27. There is an indication here of change in emphasis in food consumption and also in the use of different kinds of meat. Expressed in terms of percentages of all expenditures for meat, veal was much more important in 1816–17 than in 1926–27. The same is true of bacon, while for beef and fresh pork and ham the reverse situation is found.

Only a few unit meat prices were listed for 1816–17. In the early winter the Jacksons bought sixty-one pounds of pork for $6.10. Other items for which quantities and unit prices were entered include ten pounds of pork shoulder, $2.00, and a steak for 50 cents. Mrs. Nixon paid 97 cents for five pounds of shoulder, almost the same unit price. Her steaks ranged from 43 to 75 cents. Of course quality cannot even be guessed at in making the comparison of steak prices. The use of lard substitutes by the Nixons is in accordance with present-day customs. The absence of oils in the budget of 1816–17 is explained by the absence of salads.

Expenditures for cereals covered 16.3 per cent of the total food expenditure in 1816–17, and only 5.5 per cent in 1926–27. Here, again, is an indication of a rise in the standard of living during the last century. Also, as one could expect, there is a difference in the cereal used. In the Nixon food budget, bought bread accounted for 41 per cent of all cereal expenditures, cookies and cakes for 13.1 per cent, crackers for 11.8 per cent, and breakfast food for 14.6 per cent of the total cereal expenditure; while in the Jackson's record, bought bread accounted for only

6.9 per cent, cakes and cookies for 9.8 per cent, crackers for 1.9 per cent of all cereal expenditures, and there were of course no expenditures for breakfast food. White flour was the heavy cereal item in 1816–17, taking 69.3 per cent of the total expenditures for cereal, whereas in 1926–27 it accounted for only 3.6 per cent. Cornmeal, also, was much more important in the Jackson than in the Nixon food budget.

The Jacksons in 1816–17 paid 16⅔ cents a pound for sugar. Loaf sugar, listed only once, was 35 cents a pound. Mrs. Nixon in 1926–27 bought sugar usually in ten-pound sacks at from 59 to 69 cents a sack or at twenty-five pounds for $1.73, an average of from 6 to 7 cents a pound. While the Jacksons spent more both absolutely and relatively for sweets than did the Nixons, they got it almost entirely in the form of granulated sugar while the Nixons had a good proportion of it in prepared form such as jellies and jams.

There was little difference in the expenditures of the two families for potatoes. In October, 1816, seven bushels of potatoes including carting cost $5.50. These were apparently bought at a special price, for a few weeks later another entry lists two bushels of potatoes for $2.50. Mrs. Nixon usually bought potatoes by the peck, paying 55 cents a peck, or at the rate of $2.00 a bushel. Sweet potatoes in November, 1816, cost 50 cents a peck, while in the fall and early winter of 1926 they cost from 2½ to 5 cents a pound, or from 31 to 60 cents a peck.

The difference in the relative importance of both fruit and vegetables in the total food budget is notable. In the Jacksons' food budget vegetables took 4.4 per cent and fruit 2.6 per cent of total food expenditures, while in that of the Nixons vegetables accounted for 10.1 per cent and fruit 10.5 per cent. The root vegetables were relatively more important in 1816–17 than in 1926–27, as can be seen from the percentage of expenditure for all vegetables accounted for by turnips, parsnips, and beets. String beans seem equally popular at both dates, but cabbage is more important in 1816–17. Lettuce is only mentioned once in the 1816–17 accounts along with radishes and cucumbers, 18¾ cents being paid for the three on one occasion. In 1926–27

$13.28, or 14.5 per cent of the vegetable money, went for lettuce. Tomatoes also were relatively more important in the 1926–27 record. Oranges accounted for 23 per cent of the fruit money in 1926–27, but do not appear at all in 1816–17, as is also of course the case with grapefruit, bananas, and canned fruit and vegetables.

Social habits are interestingly reflected in the 56 cents spent for raisins in 1926–27 and the $10.19 for that item in 1816–17, when raisins, of course, went with the after-dessert wine. Wine in 1816–17 came to $75.25, 8.2 per cent of the food budget. The only counterpart of this item in the Nixon budget was 30 cents for grape juice. Raisins were listed at 37½ cents a pound in 1816–17 and almonds at 30 and 50 cents a pound. These are higher than current prices in 1926–27.

Ice-cream was ordered only once by the Jacksons, apparently for a party in July, 1817. They had five pints costing 75 cents a pint. The Nixons paid 20 cents a pint and spent $18.73 on ice-cream purchased during their account-year. The items which were ordered for the party in July, 1817, included the following: veal, 87½ cents; eggs, 37½ cents; mutton, 62½ cents; cabbage, 12½ cents; potatoes, 25 cents; cymblings, 12½ cents; huckleberries, 18¾ cents; plums, 25 cents; lemons, $1.00; rum, $1.75; wine, $2.50; ice-cream, $3.75; raisins, $1.00; filberts, 75 cents; cocoa nuts, 25 cents; cakes, $2.00; apples, 25 cents; ice, 25 cents, and a dozen and a half jelly glasses for $3.00.

The difference in the amounts spent by the two families on tea, coffee, spices, and salt is interesting. Unit prices of 1816–17 were not given for these items with the exception of nutmeg, an ounce of which was purchased for 62½ cents.

On the whole, then, while these two families had total food budgets of almost the same amount, a comparison of the kinds of food consumed shows the advance in scientific knowledge of diet, and the improvement in transportation and marketing facilities during the last century.

In measuring the changes in the level of living between 1816–17 and 1926–27, it is perhaps significant to note that, if the Nixons' expenditures in 1926–27 on items not available in

1816–17 and the difference between what they spent and what the Jacksons spent in 1816–17 on items which have been greatly improved or made more available are added to the total expenditures of the Jacksons, a figure is obtained very close to the Nixons' total expenditures. This can be more clearly seen by reference to Table IV.

TABLE IV

EXPENDITURES OF A PROFESSIONAL FAMILY IN 1926–27 ON ITEMS NOT AVAILABLE OR NOT EASILY AVAILABLE IN 1816–17, AND THE DIFFERENCE BETWEEN THEIR EXPENDITURES AND THOSE OF A SIMILAR FAMILY IN 1816–17 ON ITEMS IN WHICH THERE HAS BEEN GREAT IMPROVEMENT SINCE 1816–17

Prepared breakfast food	$ 7.03	Household supplies*	$ 15.06
Canned vegetables	21.36	Laundry sent out	26.60
Canned fruit	23.59	Health*	111.60
Oranges	22.16	Reading matter*	47.28
Clothing*	400.43	Recreational equipment	36.47
Housing*	1,050.70	Vocation*	68.00
Fuel*	48.94	Children's equipment*	39.74
Light*	39.60	Toilet supplies, etc.	34.63
Water	10.60	Automobile	166.18
Telephone	34.98	Life insurance	292.15
Ice*	32.75	Total	$2,529.85

* Amounts for items so marked indicate excesses of expenditures of 1926–27 over those of 1816–17.

While, of course, the various factors making for social change cannot be entirely separated one from the other, still the expenditures for prepared breakfast foods, canned fruit and vegetables, and laundry sent out reflect chiefly the development of factory production. Advances in pure science and in engineering skill are mainly responsible for the expenditures for more comfortable, sanitary, and labor-saving housing, for running water, for furnace heat, for gas for cooking and for heating hot water, for electricity for light and power, for telephone, for recreational equipment, for automobile, and for a better diet. Increased knowledge of medicine, of dentistry, and of child development explain the expenditures for health and for children's equipment. Newer business methods which provide household and toilet supplies in convenient and attractive packages, popularize beauty parlors, advertise ready-made clothing and style

changes, and sell insurance account for still other items on the list.

If to this $2,529.85 accounted for by these new and better items available in 1926–27 are added the $225.60 which the Nixons saved and for which the Jacksons had no counterpart, and the $1,986.65 covering all the expenditures of the Jacksons, a total of $4,742.10 is obtained, which is not very far from the Nixons' total expenditure of $4,853.83. Whether, considering the wealth of the country and the state of the arts at the two periods, the professional family in 1926 was, relatively to other social classes, better off than in 1816 is an interesting question for speculation. But there is no doubt that in terms of comforts, conveniences, and luxuries the professional family of today as represented by the Nixons is much better endowed than its counterpart of one hundred and ten years ago.

CHASE GOING WOODHOUSE

UNITED STATES BUREAU OF HOME ECONOMICS

SIR EDWARD WEST (1782–1828)

EDWARD WEST, who was born on March 1, 1782,[1] had distinguished ancestors. His grandfather, Temple West, was an admiral, and his father, Balchen West, was receiver-general for Hertfordshire. When the latter died prematurely, Edward West was left under the guardianship of his uncle, Sir Martin Browne Ffolkes, F.R.S., of Hillingdon Hall in Norfolk.[2] From Harrow School, West went up to University College, Oxford, in 1800, the year in which "the long-debated New Examination Statute" which imposed an examination by public examiners upon candidates for degrees, received the assent of Congregation.[3] In 1804 West graduated with high honors. He became Master of Arts in 1807, and was a fellow of University College until 1823.[4]

West was called to the bar in 1814 and commenced to practice in chambers in Hare Court, Temple. Just as he had always been a keen student, so he was a most hard-working barrister; and that at a period when the inconveniences of life were more marked than they now are. From a letter written while he was on circuit in January, 1822, in which he says that his coach took ten hours to go from London to Oxford, we get a glimpse of the difficulties of travel in the prerailway era. In the summer of the same year it took West and his wife, en route for Bombay, seven days to reach Spithead from London by way of Canterbury, Deal, and the Channel. Throughout his career West showed himself to be a man of outstanding ability, enormous energy, and considerable courage. For a quarter of a century

[1] Lady West's Journal, March 1, 1827.

[2] F. D. Drewitt, *Bombay in the Days of George IV* (1907), p. 18.

[3] It actually came into force in 1802 (Mallet, *History of the University of Oxford*, III, 167–68). For a picture of Oxford life in West's day see Elizabeth Grant, *Memoirs of a Highland Lady* (ed. Lady Strachey), chap. vii.

[4] Foster, *Alumni Oxonienses (1715–1886)*, p. 1526.

he combined successfully the study of economics with the study and practice of law. In 1815, his *Essay on the Application of Capital to Land* presented to the world, as Ricardo said, nearly at the same moment as Malthus, the true doctrine of economic rent, thus helping to correct economic theory upon a point which Adam Smith had failed to treat satisfactorily. West's *Essay* was written, he tells us, with the primary object of publishing

> a principle in political economy, which occurred to me some years ago; and which appears to me to solve many difficulties in the science, which I am at a loss otherwise to explain. . . . . The principle is simply this, that in the progress of the improvement of cultivation the raising of rude produce becomes progressively more expensive, or in other words, the ratio of the net produce of land to its gross produce is continually diminishing.[5]

The essay had also a secondary object; namely, "to shew the fallacy of the arguments of those who have maintained, that the bounty on the exportation of corn granted by the legislature in 1688, rendered that article cheap." West stated that in agriculture returns always tend to diminish because of the necessity of having recourse to inferior land, whereas "the division of labour and application of machinery render labour more and more productive in manufactures, in the progress of improvement." In company with Malthus[6] and Ricardo, West thought that improvements in agriculture could administer only temporary checks to the operation of the law of diminishing returns.[7]

In 1827 a writer in *Blackwood's Magazine* asserted that "the new doctrine of Rent . . . . although adopted and applied to most important consequences by Mr. Ricardo, is not originally his, or claimed by him, but is Sir Edward West's."[8] But, two months later, a correspondent called attention to the fact that the doctrine of economic rent had been expounded by an anonymous essayist in a periodical called the *Bee*, published in Edin-

[5] Pp. 1–2. As Professor Cannan points out, Turgot had stated this principle in 1768; see *Wealth* (3d ed.), pp. 48–50.

[6] West quotes from the third edition (1806; 2 vols.) of the *Essay on Population;* see West's *Essay*, pp. 44, 61, and 65. West's reference on p. 44 to "Malthus, b.3. c.8. p. 309" should read "pp. 208–9."

[7] Cf. Cannan, *Theories of Production and Distribution*, pp. 172–74.

[8] *Blackwood's Magazine*, January, 1827.

burgh in 1791.[9] The essay referred to was, in fact, written by Dr. James Anderson, the editor of the *Bee*, in response to a request received from an East Lothian farmer who had read a previous article, "On the Corn Laws," in which Anderson had said (in a footnote), "I am aware that some persons will imagine that rent enters in some measure into the constituent price of grain; but I shall afterwards have occasion to show that this is a fallacious notion. . . . ."[10] The article is not a complete anticipation of the Ricardian theory of rent, but a restatement of Anderson's theory, originally published in 1777, that rent was a premium, "a medium by means of which the expense of cultivating soils of very different degrees of fertility may be reduced to a perfect equality."[11] He called the article in the *Bee*, "A Disquisition on the connection that subsists between Rent, and the price of Grain, and their mutual influence upon each other." The effect of rent, he says, on the price of grain "has not been hitherto fully elucidated." Grain can in no case be raised without some labor and expense, or cost, which must be recovered by the grower. This may be said to constitute "its intrinsic price." All other circumstances being alike, the intrinsic price of grain must vary with the fertility of the soil upon which it is produced. "Rent is, in fact, nothing else than a simple and ingenious contrivance for equalising the profits to be drawn from fields of different degrees of fertility, and of local circumstance, which tend to augment or diminish the expense of culture." Anderson then supposes that "all the soils are arranged in classes" (denoted by the letters A, B, C, D, E, F, G, etc.) according to their degrees of fertility, and proceeds to show that if class A is the richest soil, and if the effective demand is "such as to raise the price of grain, say, to sixteen shillings per boll," then those persons who cultivated the fields in class F, the produce of which is just sufficient to defray all expenses and no more when corn is at that price, "would be able to afford no rent at all, nor could any rent be afforded in this case, for those of G, or other more sterile

[9] *Ibid.*, March, 1827, p. 311.

[10] The *Bee*, March 16, 1791, p. 54.

[11] *Cf.* Cannan, *op. cit.*, pp. 220–21 and 371–73.

fields *for the purpose of rearing corn;* but it is also evident, that those who possessed fields in the class E, could . . . . afford a rent to the proprietor. . . . ." Anderson next supposes an insufficiency of produce relatively to the population, and a price increase from 16*s.* to 17*s.* per boll. Now, he says,

> the fields G, being brought into culture, those in the class F would . . . . be able to afford a rent equal to one shilling per boll . . . . and all the other classes could admit a similar rise. Here then, we clearly perceive, that it is the price of grain that affects the rent, and not the rent that affects the price of grain, as has been very often mistakenly alleged.[12]

West's assumptions are very similar; namely, an increasing population, "innumerable" gradations of the soil between the richest land (i.e., land of the best quality and most convenient situation) and the poorest, and tillage gradually extending under "the pressure of population" to "poor land, or that at least which is second in quality to what is already cultivated"—soils that are "comparatively ungrateful and exhausted."

From the composition of his first essay in economics West turned with equal facility to the writing of his first and only legal treatise, *A Treatise of the Law and Practice of Extents in Chief and in Aid* (1817).[13] The main materials for this work were scattered among the old MS reports of cases, the printed reports of later cases, and notes of the most recent decisions either taken by West himself or obtained from the counsel who argued the points at issue. For this treatise, which became a standard work, a place would have to be found in any complete account of the reform of abuses in the Court of Chancery. It remains as a reminder of its author's thoroughness and sound learning in law.

But West's influence as a writer is subordinate to his work as an Indian judge. He was one of the "king's judges" sent out under the Regulating Act of 1773 to check the abuses that had grown up under the East India Company's régime; and in the few years that elapsed before the climate of India added his name to the long death-roll of Indian administrators, he discharged his duties with a fearless integrity and devotion which

[12] The *Bee*, December 28, 1791, pp. 293–300.

[13] West defined an extent (p. 1) as "an execution at the suit of the Crown."

are beyond praise. On July 5, 1822, Mr. Wynn, the president of the Board of Control, presented West to the king, who then conferred a knighthood upon him to mark the occasion of his appointment to the post of recorder of Bombay.[14] Seven weeks later Sir Edward West married his cousin, Lucretia Ffolkes, and on September 5, 1822, they set out for Bombay.[15]

The voyage to India in those days was a matter of months. They arrived off Bombay on February 2, 1823, and landed on the following day. After her first ten days in India, Lady West wrote in her Journal, "More morning visitors. They appear to be quite endless. . . . . Edward much engaged with petitions. The Court is in sad order, but he will soon make it better."

On February 21, 1823, she wrote, "We continue to dine early, find our evening drives very pleasant, but the returning Visits is a great bore, as all the people I have yet seen are unpleasing and vulgar, and wishing to be Fine ladies; I foretell that I shall not be intimate with any, and we shall live happily to Ourselves." Two years later Lady West wrote to her sister-in-law, ". . . . Being usually the Only Lady I learnt to play short Whist with Edward, who says I play very well; but I must tell you he usually thinks all I do is well, I believe I may say there were never two People happier in each other."[16]

With the exception of the Admiralty Court (founded in 1684), the first regular Court of Justice at Bombay was the Mayor's Court which was established by charter in 1728. Seventy years later this was superseded by a Recorder's Court,[17] and it was to the post of recorder that West was appointed in the middle of 1822, in succession to Sir William Evans. Under an Act of Parliament of 1823[18] the Recorder's Court was transformed into a Supreme Court of Judicature,[19] and Sir Edward

[14] *Times*, July 6, 1822.

[15] Drewitt, *op. cit.*, p. 34.

[16] Letter from Lady West to Mrs. Lane, of Glympton Park, Woodstock, March 6, 1824, quoted by Drewitt, *op. cit.*

[17] Sir William Syer was the first recorder.

[18] 4 Geo. IV, c. 71.

[19] W. Foster, *Guide to the India Office Records* (1919), p. 91.

West was promoted to be chief justice of the new court at a salary of 52,200 Bombay rupees per annum.[20] News of the impending promotion reached West on October 27, 1823, and about six months later, a second judge, Sir Charles Harcourt Chambers, arrived at Bombay. On May 8, 1824, West and Chambers took their seats for the first time in the new Supreme Court of Bombay.

Although West's legal labors left him relatively little time for other pursuits, he never abandoned his economic studies. His pamphlet, *The Price of Corn and Wages of Labour, with observations upon Dr. Smith's, Mr. Ricardo's, and Mr. Malthus's doctrines upon those subjects,* was commenced before he sailed for India, and he tried to complete it during the voyage. "As I foretold," wrote Lady West to her sister-in-law in November, 1822, "he has not finished his Pamphlet to send home from the Cape, but he will, I hope, do so from Bombay, as we (? intend) to live as retired as possible, and get Home at the end of seven years. . . . . We hope we shall get our Books and things there safe, but it is a constant anxiety. . . . ." Lady West's Journal contains several references to her husband's interest in economics. The first is on May 1, 1823, two months after their arrival in Bombay.

> Edward decided on a most interesting case yesterday about Money and Interest, with which he felt quite at home. It had been pending twenty years, and had excited great anxiety. He ought to be popular with all the People. He is active and kind to their interests, I believe the natives feel it already. We are living the quietest life possible, going to bed at 9, getting up at ¼ to 5.[21]

By working at it chiefly during vacations when the courts were not sitting, West had completed his pamphlet at the end of 1823 or early in 1824. Lady West's Journal records, "April 17 (1824). Edward breakfasted at Malabar Point with Mr. Elphinstone, to

[20] 4 Geo. IV, c. 71, sec. x.

[21] The case referred to was one in which a Parsee merchant was claiming payment of certain sums from the government. Sir E. West declared that the claimant had been treated most shamefully, and awarded him the original sum plus fifteen years' interest.

talk over Political Economy and show him his MS., which I wish he had published, but he always waits to make things perfect, and loses the proper moment."

It is almost certain that West continued to work on the pamphlet, as far as his legal labors would allow, for about another year. It is quite certain that it was eventually published in London in 1826. Not content with the two essays he had written so far, and in spite of the wear and tear of his life and work in the Indian climate, West now began to write a book on economics. Towards the end of 1825, Lady West made the following entries, "November 18. Edward has begun again his Political Economy. . . . . November 26. . . . . Edward's purvoe has arrived to copy his Political Economy. . . . ." There is no further reference to the work until August, 1827, after which we get four entries referring to it.

August 6 (1827). I am up today having been six weeks in bed. . . . . Edward still busy on his Political Economy.

September 14. Edward has sent off 2 letters to John Macbride[22] and Mr. Long about the publication of his Book on Political Economy.

October 4. Poor Edward is very unwell. He has, I think, fagged too much at Political Economy.

July 18 (1828). . . . . Edward has two letters, one from Mr. Way, the other from Dr. Macbride; the first kind, the other flattering to Edward as a Judge and a Political Economist.

West left the MS of his book among his papers when he died, but it was never published. I believe that the MS is still in existence, but so far I have not been successful in tracing it.

In 1824 West was offered the post of chief justice of Madras; but he hesitated to accept. He had done a great deal of "donkey work" at Bombay in the face of considerable opposition; he had produced order out of chaos; and he had made a number of friends. For these reasons he was strongly inclined to stay at Bombay until his seven years had expired. Early in 1825, Lady West wrote, "January 14. . . . . About the C.J. of Madras he knows not how to decide. . . . . Edward has done and is still doing so much good. The natives say they shall petition Edward to stay if they think he is likely to go away." In the

[22] Principal of Magdalen Hall, Oxford.

end West declined the post, and Sir Ralph Palmer was appointed.

The bulk of West's judicial work in India was done in the bad old days before the changes of the period 1828–33; at a time when the existing standard of morality was extremely low and when a judge who acted upon a higher conception of justice and duty was bound to find himself, so far as the European element was concerned, almost alone amidst a sea of difficulties and unpopularity.[23] Nevertheless, in spite of the suspicion and enmity of the "vested interests" in and around the Court, and of the East India Company, West made and maintained a place in the van of the pioneers of a new and better era. His "meritorious exertions" won the full approval not only of his colleague, Sir Charles Chambers, but also of the president of the Board of Control. The *Times* described West as

> a man of great talents and moral qualities. . . . . In his judicial capacity his conduct was marked by a zeal for justice and a determination to discountenance oppression, which made him a favourite, we believe, with the natives, though his occasional warmth of temper (justified perhaps by the abuses which he had to control) set him at variance with some of the lawyers of the Presidency.[24]

Various entries in Lady West's Journal give confirmation to this estimate. Fenwick, the master in equity in the Supreme Court of Bombay, said that flogging of the natives had decreased markedly since West's arrival. Moreover, he reformed not only the Court, but the jail; irregularities of all descriptions were checked, and "the law's delays" were considerably reduced. Lady West's Journal records,

> June 12 (1823). Edward has been much engaged in Court detecting frauds . . . . he came to administer justice and correct abuses, and he will do it . . . . but it will make him unpopular. . . . .
>
> August 24 (1823). . . . . Edward's life will not be a bed of roses. From hearing Petitions such extraordinary things come out. Mr. G.[25] has the natives flogged without any examination, trial, or usual formality. A Friend sends a note to him and says, "Pray flog the Bearer," and it is done. . . . . Edward will have it all corrected.

[23] Cf. Mackintosh, *Life of Sir James Mackintosh* (1836), Vol. I.

[24] *Times*, January 29, 1829. [25] One of the police magistrates.

All this uphill work had to be done under the constant shadow of death. The mortality rate among British officials in India a century ago was appallingly high. Dr. Dawtrey Drewitt tells us that between 1802 and 1828 the average length of life of a king's judge after arrival in Bombay was three years and ten months! In the Commons debate on the East India Judges Bill on May 13, 1825, when it was proposed that the salaries of Indian judges should be raised to 60,000 rupees per annum, the president of the Board of Control stated that "the great loss of life rendered it necessary to offer every temptation to persons properly qualified to fill these offices."[28] Sir Edward West survived for five years and a half; but, like the great majority of his predecessors and colleagues, he did not reach the end of his seven years tour of duty. He died "in harness" on the morning of Monday, August 18, 1828, at the early age of forty-six.

After West's death, 140 of the principal Hindu, Parsee, and Mohammedan merchants of Bombay took the unprecedented course of presenting to the judges of the presidency an address of appreciation of the services of the deceased chief justice. They said:

> We are conscious that it is a novelty for the people to come forward to address a Bench of English Judges on such a subject: it is no less a novelty (actually witnessed by many of us), to be rescued in the short space of twenty-nine years since the establishment of a regular court of British law in this Island, from the evils of an inefficient and irregular administration of justice which previously existed.

The address then refers to the fact that the benefits of the new régime had been largely extended and confirmed by the efforts of Sir Edward West, who was at all times "so able and indefatigable, so undaunted and upright." The natives were impressed by the even-handed justice of his decisions, by the extent to which he had sacrificed private convenience to the public service, and by "the easy access which that humane and honourable Judge at all times afforded to the poor and needy." During West's tenure of office the statute allowing natives to act as jurymen had been passed. This law was much easier to make than to

[28] *Hansard* (new series), XIII, 589.

administer, owing to the religious beliefs and the peculiarities and prejudices of the different elements in the Indian population, and West had been at great pains to confer the privileges of the statute upon the natives without doing violence to their sentiments. That his efforts as a whole were appreciated by them is beyond question, for the address closes with the announcement that they had

> . . . . raised a sum of money, which it is designed to make over to the Native Education Society, to be vested by them in Government securities for the endowment of one or more scholarships, and the distribution of one or more annual prizes . . . . to be denominated "Chief Justice West's Scholarships and Prizes." Engaged as the late Judge was himself so earnestly in improving the condition of the natives, we humbly hope that we have devised the most durable and appropriate method of perpetuating the grateful recollection of him among them, and training up our children to the proper discharge of those public duties to which he first showed them the way.[27]

A notice in a similar appreciative strain appeared in the *Bombay Gazette* of August 27, 1828. West was described as "in person rather below the middle size and well proportioned. His eyes were light grey, and the contour of his head was particularly striking, and gave an elevated and distinguished expression to his face." The notice proceeded to commend West's thorough grasp of general principles and an adroitness in detail due to long practice, which enabled him to discharge his duties "with the most perfect ease and coolness." "In his judgments of more important cases nothing could exceed his anxiety to arrive at a right decision. . . . ."

There is, I think, little doubt that had Sir Edward West lived to retire to England at the end of his term of office, he would have continued to work at economics with renewed vigor and maturer judgment, his mind enriched by his experiences and observations of economic phenomena in India; and the literature of the subject would have received further contributions from his pen.

ALFRED PLUMMER

RUSKIN COLLEGE, OXFORD

[27] *Gentleman's Magazine*, XCIX (1829), 565–66.

AN ESTIMATE OF THE VOLUME OF DEPOSIT CURRENCY IN THE UNITED STATES[1]

PROFESSOR FISHER'S ESTIMATE: 1896–1909

THE pioneer attempt to estimate the volume of deposits subject to check was made by Professor Fisher,[2] whose results cover the years 1896–1909. His method is a complicated one, and only a bare outline of it can be given here. From the annual reports of the Comptroller of the Currency he compiles figures for individual deposits, to which he adds the estimated deposits in non-reporting banks and from which he makes deduction for (1) the deposits of trust companies and savings banks and bankers' deposits which are misclassified as individual deposits for the years 1896–99, (2) the deposits in savings banks, and (3) the exchanges for clearing house. His estimate for the deposits of the banks from which the Comptroller has not secured reports is at best a rough one. The figures for

[1] For advice and suggestions in connection with the making of this estimate I am indebted to Professors H. P. Willis, W. C. Mitchell, R. E. Chaddock, and F. C. Mills, of Columbia University; S. S. Kuznets, of the National Bureau of Economic Research; and Miss L. Bagwell, of the Federal Reserve Bank of New York.

[2] Irving Fisher, *Purchasing Power of Money* (Macmillan, 1922), appendix to chap. xii, pp. 434–41. Professor Kemmerer should perhaps be given the credit for making the first effort to estimate the volume of "check deposits." (See *Money and Credit Instruments in Their Relations to General Prices* [Henry Holt, 1907], Bk. II, chaps. iii and iv). On the basis of the figures taken from Professor Kinley's investigations ("Credit Instruments in Business Transactions," *Journal of Political Economy*, V, 157–74; "Credit Instruments in Retail Trade," *ibid.*, III, 203–17) he estimates that 460 millions of dollars was the total amount of checks deposited on July 1, 1896 (p. 111), which, when multiplied by 305 working days in the year, gives him the sum of 143 billions as the total check deposits of the year. For other years than 1896 for which he had no corresponding data at the time, he makes no attempt to estimate the check deposits for any single day, but he does succeed in securing figures for the total check transactions of each year by assuming that bank clearings are always 35 per cent of check transactions. As Professor Kemmerer himself admits, the data upon which his estimates are based are so uncertain that he makes no other claim than that they are better than nothing.

1900 and 1902–9 are estimates of the Comptroller, but these official figures are far from being accurate. As Professor Mitchell[3] points out, the Comptroller's estimate of the number of non-reporting institutions, upon which estimates of deposits must be based, is not trustworthy. The estimate, for instance, of the deposits of non-reporting banks at 450 millions of dollars in 1900 is dubious. If we take an average of this, we will find that it is more than a quarter greater than the average individual deposits of reporting private banks upon which estimates for deposits of non-reporting banks should be based. And yet it is upon these official figures that Professor Fisher must rely to interpolate figures for the preceding years for which no data are available. Figures for the misclassified deposits of trust companies and savings banks are not available, but Professor Fisher finds by a study of the available data of subsequent years that deposits of savings banks and trust companies in the national banks are approximately equal to the deposits of the state banks in the national banks, and therefore figures of the latter are taken instead. In the second edition of his book,[4] however, he admits that he has made an over-correction and that it would have been better if he had not made any correction for misclassification at all. Deposits in savings banks are included in individual deposits; and since Professor Fisher believes that they are not used as a circulating medium, they should be excluded from the latter. But in taking the figures for deposits in savings banks from the text of the Comptroller's reports rather than from the appendixes of the same documents, he errs in the direction of over-correction. For some reason there is a discrepancy between the figures which appear in the text and those which are found in the appendixes. The figures in the appendixes upon which the Comptroller bases his estimates for the total amount of individual deposits are considerably smaller than the corresponding figures which are found in the text.[5] Figures for clearing-house exchanges are available for

[3] W. C. Mitchell, *Business Cycles* (University of California Press, 1913), p. 313.

[4] *Op. cit.*, p. 435.

[5] *Annual Report of the Comptroller of the Currency, 1909;* compare pp. 44 and 888.

only national banks. Relying on his study of the report of the Monetary Commission in which data for all banks are given for April 28, 1909, Professor Fisher assumes that the exchanges for all banks are five-fourths of those reported by the national banks.

Thus after making corrections for the above-mentioned items, Professor Fisher arrives at the figures for net individual deposits. But not all net individual deposits are subject to check, for they still include current accounts, deposits on certificates, and other deposits. The special report of April 28, 1909, of the National Monetary Commission gives for the first time a figure for the amount of deposits subject to check, which Professor Fisher finds, after making an addition for the amount in non-reporting banks and a subtraction for clearing-house exchanges, to be 67 per cent of the net individual deposits. Dr. A. P. Andrews, at the request of Professor Fisher, made a search among the Comptroller's old records and was able to furnish data for checkable deposits for 1896, 1899, and 1906, which the latter calculates, after allowance has been made for deposits in non-reporting banks and for clearing-house exchanges, to be 85, 89, and 78 per cent of the net individual deposits of the respective years. Having now the percentage figures for 1896, 1899, 1906, and 1909, he interpolates evenly between these for the intervening years; and by applying these percentages thus derived to the corresponding figures for net individual deposits, he arrives at the desired estimate of the volume of deposits subject to check for the years 1896–1909.

PROFESSOR MITCHELL'S ESTIMATE: 1890–1911

In 1913, Professor Mitchell[6] re-estimated the volume of deposits subject to check by methods which differ somewhat from and which are a considerable improvement over those employed by Professor Fisher. Some of the data which had not been available when the latter made his estimates in 1911 were published in official documents by the time the former undertook the revision.

From the annual reports of the Comptroller of the Currency,

[6] *Op. cit.*, pp. 318–22.

Professor Mitchell compiles figures for individual deposits and individual deposits subject to check of national, state, mutual savings, stock savings, and private banks, and loan and trust companies for the years 1896, 1899, 1906, and 1909–11. Unlike Professor Fisher, who works with the total deposits of all banks together, Professor Mitchell secures data for each class of banks separately. The latter scheme is far superior, in that the proportion of deposits subject to check differs widely among the several classes of banks and that the amounts of deposits of the different classes have not the same rate of change. After corrections have been made for some time-deposits which were included with the deposits subject to check for 1896, 1899, and 1906 and for some unclassified deposits for the years 1909 and 1910, the percentages of deposits subject to check to individual deposits are worked out for each class of banks for 1896, 1899, 1906, 1909–11. Percentages for intervening years for which no definite statements of the amount of deposits subject to check have been published are interpolated on a straight line. But because the ratios of checking deposits to individual deposits in the several classes of banks for the years 1896 and 1899 are approximately equal, it is thought plausible to accept the ratios of 1896 for national, state, and private banks, and loan and trust companies as holding true for these banks throughout the years 1890–95. By applying these percentages to the aggregate individual deposits of the various classes of banks, estimates of the deposits subject to check are computed. Figures for individual deposits for all classes of banks are obtained from government publications, but those for individual deposits of non-reporting banks are estimated from the average deposits of reporting private banks and based not upon the Comptroller's estimate of the number of these non-reporting institutions but upon Barnett's corrected figures. The estimates of the deposits subject to check of the latter banks are computed by applying the ratios of checking deposits of the private reporting banks. No correction has been made for deposits of trust companies and savings banks misclassified as individual deposits; nor has any deduction been made for deposits in savings banks. By adding the estimates of the deposits subject

to check of the various classes of banks for each year, figures representing the total deposits subject to check of all banks are obtained. Deductions for clearing-house exchanges are made from the total deposits subject to check by dividing the exchanges of the national banks nearest to June 30 of each year (the date of call for all banks) by 0.797, the ratio of the national bank exchanges to the exchanges of all banks, computed from the data[7] published in the special report of the National Monetary Commission of April 28, 1909. The residue is the desired estimate which Professor Mitchell calls the "estimated deposit currency" of all banks.

PROFESSOR KING'S ESTIMATE: ANNUAL FIGURES, 1880–1920; MONTHLY FIGURES, 1914–20

In connection with his study of the elasticity of the currency of the United States, Professor King made an estimate of the volume of deposits subject to check in 1920, securing annual figures for the years 1880–1920 and monthly figures covering the period 1914–20. In the paper in which he presented his results[8] nothing is said as to the methods by which he arrived at the figures except for the laconic statement that it was "estimated by means of a careful analysis of official government reports." Fortunately it was possible for me to interview his computer, Miss Lucile Bagwell, of the Statistical Department of the Federal Reserve Bank of New York, formerly of the Bankers Statistics Corporation, who kindly explained to me with the aid of some of her original worksheets, how the monthly figures for the entire period and the annual figures for the years for which definite statements concerning checkable deposits have been published, were computed. I am, however, unable to ascertain the methods employed in interpolating the annual figures for the period between 1880 and 1896 and for the intervening years between 1896 and

[7] An allowance has been made for the exchanges estimated to have been held by the non-reporting banks. The estimate is made on the assumption that the exchanges of these banks bear the same proportion to deposits as the private banks.

[8] "Is Our Currency Elastic?" *Bankers Statistics Corporation, Interlocking Chart, Series No. 4, Special Service*, II, No. 23 (September 21, 1920), 9–10.

1899 and between 1899 and 1909.[9] The methods adopted for securing annual figures for years for which the amounts of checkable deposits have been officially published are simple and in many respects resemble those of Professor Fisher. (1) From the annual reports of the Comptroller of the Currency annual data of deposits subject to check for all classes of banks from which the Comptroller has reports are compiled. (2) A correction is made by subtracting the deposits subject to check reported to be held by the stock and mutual savings banks from the total checkable deposits of all banks.[10] (3) To these figures thus corrected is added the total amount reported to be in the national banks on June 30 as "time-deposits on open account" or as "other time-deposits."[11] (4) Four-fifths of the amount which is reported under the caption "deposits not classified" in all except national and stock and mutual savings banks are considered to be subject to check and are therefore added to the total deposits subject to check in all banks.[12] (5) An addition is next made for the estimated checkable deposits of the non-reporting banks. This esti-

[9] The earliest date for which we have a definite statement of the amount of checkable deposits is 1896. Deposits subject to check figures for 1896, 1899, 1906, and 1909 are published by Dr. Andrews in his *Statistics for the United States, 1910*, pp. 151–52.

[10] The reason for this deduction is unknown. Professor Fisher excluded individual deposits of savings banks from the total individual deposits, believing that the former are not used as a circulating medium; but the deposits which Professor King deducts are reported to be subject to check by the Comptroller.

[11] I am unable to obtain satisfactory explanation from either Professor King or his computer as to why these time deposits should be included among those which are classified as subject to check. The Comptroller, too, to whom I wrote, was not able to enlighten me on the checkability of this item. It may be that these open-account time deposits can be quickly converted into checkable demand deposits, but so can demand deposits on certificates and other deposits of that investment nature. Indeed, Professor King frankly admits in another paper that his assumption that these open-account deposits are subject to check is a debatable one. See "The Precious Metal Basis Underlying Our Currency," *Interlocking Chart Series, No. 2, Weekly Service* (Bankers Statistics Corporation), II, No. 12 (July 6, 1920).

[12] I am at a loss as to why this proportion is taken. Nor do I know why the "deposits not classified" of the national banks are excluded. The unclassified deposits of the savings banks are of course excluded on the ground that the proportion of these deposits which is subject to check is negligible.

mate is made by multiplying the deposits subject to check of all except the mutual and stock savings banks by the ratio of the estimated individual deposits reported by the Comptroller to be in the non-reporting institutions to the total individual deposits of all banks. (6) Finally, a deduction for clearing-house exchanges is estimated by taking five-fourths of the exchanges reported to be in the national banks on June 30. Thus, by way of a summary, we may say that Professor King arrives at his final annual estimates of the amount of deposits subject to check by making additions for the "time-deposits on open account" in national banks, the estimated proportion of the "deposits not classified," and the estimated checkable deposits of non-reporting banks to, and subtractions for the deposits subject to check of savings banks and the estimated clearing-house exchanges of all banks from, the total individual deposits subject to check of all reporting banks.

His monthly figures are interpolated on the basis of the national-bank figures for deposits subject to check at dates of call and on the assumption that the changes in the national banks from call to call are characteristic of the entire system. Thus with a single annual figure, four or five other figures at national-bank dates of call are derived. From these, monthly figures are computed by straight-line interpolation.

ANNUAL FIGURES—1900–1926

Since 1910, annual figures, as of June 30, for individual deposits subject to check of all banks from which the Comptroller

TABLE I

INDIVIDUAL DEPOSITS SUBJECT TO CHECK IN REPORTING BANKS, 1912-26

Year	Individual Deposits Subject to Check in Reporting Banks, in Millions of Dollars	Year	Individual Deposits Subject to Check in Reporting Banks, in Millions of Dollars
1912.....	8,323.4	1920.....	15,679.4
1913.....	8,240.9	1921.....	16,074.1
1914.....	9,539.6	1922.....	14,334.1
1915.....	9,363.1	1923.....	14,248.4
1916.....	12,045.9	1924.....	15,061.9
1917.....	10,632.3	1925.....	16,563.2
1918.....	12,116.4	1926.....	18,205.6
1919.....	14,721.7		

secures reports have been published regularly in the annual reports of the Comptroller of the Currency. The figures in Table I are compiled from this source. It will be noted that this table begins with 1912. I have made no effort to re-estimate the volume of deposits subject to check previous to that date. Since 1913, when Professor Mitchell made his estimates, no additional data on checkable deposits have been published. And in the absence of any better methods of estimation than those adopted by Pro-

TABLE II

ESTIMATE OF THE AMOUNT OF INDIVIDUAL DEPOSITS SUBJECT TO CHECK OF NON-REPORTING BANKS, 1912–26

Year	Number of Reporting Private Banks (1)	Individual Deposits Subject to Check of Reporting Private Banks, in Thousands of Dollars (2)	Average Individual Deposits Subject to Check in Reporting Private Banks, in Thousands of Dollars (3)	Number of Non-reporting Banks (4)	Estimated Amount of Individual Deposits Subject to Check of Non-reporting Banks, in Millions of Dollars (5)
1912.....	1,110	78,340	70.6	3,800	268.2
1913.....	1,016	75,836	74.6	3,261	243.4
1914.....	1,064	67,896	63.8	3,246	207.1
1915.....	1,036	67,576	65.2	3,003	195.9
1916.....	1,014	80,549	79.4	3,000	238.3
1917.....	936	85,284	91.1	2,830	257.9
1918.....	1,091	71,445	65.5	2,600	170.3
1919.....	1,017	53,523	52.6	2,483	130.7
1920.....	799	44,852	56.1	837	47.0
1921.....	708	53,998	76.3	446	34.0
1922.....	673	48,121	71.5	445	31.8
1923.....	604	29,456	48.8	417	20.3
1924.....	560	42,516	75.9	461	35.0
1925.....	523	42,636	81.5	437	35.6
1926.....	495	43,306	87.5	273	23.9

fessor Mitchell, and believing that his results are as accurate as the data permit, I have accepted his estimates for the years 1900 to 1911.

These figures as they stand are subject to several corrections. In the first place they do not include the amounts of deposits subject to check in certain banks from which the Comptroller fails to receive reports. Nor has any attempt been made on his part to ascertain the volume of these checkable deposits of the non-reporting institutions. We are therefore compelled to make estimates. On the assumption that these non-reporting banks are private institutions, we may estimate their checkable deposits by

multiplying the average deposits subject to check of the reporting private banks by the number of banks for which no reports are obtained.[13] To the individual deposits subject to check of all reporting banks we thus add the corresponding estimates of individual deposits subject to check of the non-reporting banks.

Moreover, in the second place, these adjusted figures are subject to a further correction for clearing-house exchanges. Exchanges, as Professor Fisher points out,[14] represent checks which

TABLE III

EXCHANGES FOR CLEARING HOUSE OF REPORTING BANKS, 1912–26

Year	Exchanges for Clearing House of Reporting Banks, in Millions of Dollars	Year	Exchanges for Clearing House of Reporting Banks, in Millions of Dollars
1912.....	374.9	1920.....	849.9
1913.....	285.1	1921.....	1,049.5
1914.....	389.1*	1922.....	930.6
1915.....	307.2	1923.....	646.6
1916.....	488.8	1924.....	1,117.4
1917.....	486.1	1925.....	1,227.0
1918.....	359.8	1926.....	1,111.5
1919.....	831.7		

* Exchanges for clearing house for the year 1914 for all except the national banks are not given separately but are included under the caption "Checks and Other Cash Items." The figure 389.1 is an estimate computed by multiplying the clearing-house exchanges of the national banks, given by the Comptroller as of June 30, 1914, by the ratio of the average of the exchanges of the national banks on June calls for the years 1913 and 1915 to the average of the exchanges of all reporting banks for the same years.

have been deposited by the persons receiving them, but which have not yet reached the bank upon which they are drawn. Because of the time element which intervenes between the collection of a check by a bank with which it is deposited and its final entry in the books of the bank against which it is drawn, it is temporarily counted twice—once by the bank in which it has been placed for collection, and again by the home bank—and the only record of the deduction which should be made is in the exchanges for clearing house. We must accordingly deduct the figures assembled in Table III which represent the clearing-house ex-

[13] Approximately the same result may be secured by first estimating the individual deposits of the non-reporting banks and then by multiplying these estimates thus obtained by the corresponding percentages of individual deposits subject to check of the private banks to individual deposits of the same latter institutions.

[14] *Op. cit.*, pp. 436–37.

changes for all reporting banks as published by the Comptroller in his annual reports. A correction must, however, be made in the exchange figures, for they do not include the exchanges of the non-reporting banks. An estimate of these must therefore be made. This can easily be accomplished by multiplying the estimated amount of the deposits subject to check of the non-reporting banks by the ratio of the exchanges of the private banks to the deposits subject to check of the latter institutions.

TABLE IV

ESTIMATE OF THE AMOUNT OF EXCHANGES FOR CLEARING HOUSE OF NON-REPORTING BANKS, 1912–26

Year	Individual Deposits Subject to Check of Private Banks, in Thousands of Dollars (1)	Exchanges for Clearing House of Private Banks, in Thousands of Dollars (2)	Percentage of Exchanges of Private Banks to Individual Deposits Subject to Check (3)	Estimated Individual Deposits Subject to Check of Non-reporting Banks, in Millions of Dollars (4)	Estimated Clearing House Exchanges of Non-reporting Banks, in Millions of Dollars (5)
1912.....	78,340	233	0.30	268.2	0.8
1913.....	75,836	151	0.20	243.4	0.5
1914.....	67,896	195*	0.29	207.1	0.6
1915.....	67,576	147	0.22	195.9	0.4
1916.....	80,549	153	0.19	238.3	0.5
1917.....	85,284	251	0.29	257.9	0.8
1918.....	71,445	344	0.48	170.3	0.8
1919.....	53,523	371	0.69	130.7	0.9
1920.....	44,852	307	0.68	47.0	0.3
1921.....	53,998	134	0.25	34.0	0.1
1922.....	48,121	162	0.34	31.8	0.1
1923.....	29,456	283	0.96	20.3	0.2
1924.....	42,516	155	0.36	35.0	0.1
1925.....	42,636	200	0.47	35.6	0.2
1926.....	43,306	74	0.17	23.9	0.0

* This figure is not given by the Comptroller but is estimated by multiplying the clearing-house exchanges of the national banks of June 30, 1914, by the ratio of the average exchanges of the private banks for the years 1913 and 1915 to the average exchanges of the national banks on June calls of the same years.

Finally, an adjustment must be made in the original figures for the considerable amounts of "deposits not classified"[15] which the Comptroller is unable to apportion. By classifying the indi-

[15] The unclassified deposits make up on the average for the period 1917–26, 16 per cent of the total individual deposits and 41 per cent of the total individual deposits subject to check for all reporting banks. The highest percentage of unclassified deposits is found in the loan and trust companies; 40 per cent is found to be the average of the period; state banks claim 24 per cent; private banks, 23 per cent; stock savings banks, 17 per cent; and national banks, 3 per cent.

vidual deposits of the state banks, stock and mutual savings banks, loan and trust companies, private banks, and national banks into "deposits subject to check," "demand certificate of deposits," "certified and cashier checks," "savings deposits," "time certificate of deposits," "deposits not classified," etc., and by computing percentages of the latter to the former, it is found that there is in general an inverse relation between "deposits subject to check" and "deposits not classified" of the several classes of banks. It seems, then, that the most plausible procedure is to distribute the "deposits not classified" of the various classes of banks separately in accordance with the percentages of deposits subject to check to the total classified individual deposits of the different classes of banks. This is tantamount to apportioning the unclassified deposits between the deposits which are and the deposits which are not subject to check. However, since practically all the accounts of the mutual and stock savings banks are savings deposits,[16] it is deemed feasible to omit these banks in the distribution. The error incurred in the exclusion would be small if not negligible.

There still requires to be made an allowance for the "deposits not classified" which are subject to check in the non-reporting banks. It should be recalled that our estimates of the checkable individual deposits of the non-reporting banks are computed on the assumption that these institutions have the same proportion of checkable deposits to individual deposits as the private banks. In making an addition for the amounts of "deposits not classified" which are checkable in the private banks, we have in reality increased the ratios of the checkable deposits to individual deposits of these private institutions to the extent of the correction made. We should accordingly augment the checkable deposits of

[16] The average percentage of deposits subject to check to individual deposits of the mutual savings banks is 0.7 per cent and of the stock savings banks, 3 per cent. The latter percentage is computed from the percentages of eight years only, those for 1919 and 1920 being omitted. For some unknown reason the deposits subject to check of these banks attained the unprecedented height of 62 per cent in 1919 and 64 per cent in 1920. For national banks, 65 per cent of their individual deposits is found on the average to be checkable; for state banks, 51 per cent; for loan and trust companies, 56 per cent; and for private banks, 44 per cent.

the non-reporting banks in the same proportion as the private banks. An estimate of the amounts of individual deposits of the

TABLE V

ESTIMATE OF THE AMOUNT OF "DEPOSITS NOT CLASSIFIED" SUBJECT TO CHECK OF REPORTING BANKS, 1917–26

Year	Deposits Not Classified, in Millions of Dollars (1)	Percentage of Deposits Subject to Check to Classified Individual Deposits (2)	Estimated Amount of Unclassified Deposits Subject to Check, in Millions of Dollars (3)	Deposits Not Classified, in Millions of Dollars (1)	Percentage of Deposits Subject to Check to Classified Individual Deposits (2)	Estimated Amount of Unclassified Deposits Subject to Check, in Millions of Dollars (3)
	State Banks			Loan and Trust Companies		
1917.....	1,232.3	50.0	616.2	2,869.8	57.1	1,638.7
1918.....	1,087.3	68.4	743.7	2,322.5	55.7	1,293.6
1919.....	2,177.6	60.0	1,306.6	2,820.2	47.9	1,350.9
1920.....	3,323.9	45.1	1,499.1	2,740.7	53.0	1,452.6
1921.....	2,077.0	48.1	999.0	216.3	65.7	142.1
1922.....	2,359.1	47.4	1,118.2	2,838.7	56.1	1,592.5
1923.....	3,511.6	45.9	1,611.8	2,779.5	54.6	1,517.6
1924.....	3,654.7	47.6	1,739.6	3,436.6	57.7	1,982.9
1925.....	3,667.0	49.3	1,807.8	4,008.2	57.8	2,316.7
1926.....	1,635.3	47.7	780.0	3,078.1	47.5	1,462.1
	Private Banks			National Banks		
1917.....	15.3	58.2	8.9	.....	.....	.....
1918.....	68.2	57.1	39.0	164.2	72.4	118.9
1919.....	77.1	38.4	29.6	200.2	70.4	140.9
1920.....	28.8	31.9	9.2	223.7	69.4	155.2
1921.....	15.2	45.5	6.9	368.4	64.9	239.1
1922.....	29.6	41.6	12.3	375.2	66.0	247.6
1923.....	44.3	33.7	14.9	671.9	62.7	421.3
1924.....	33.1	48.6	16.1	774.7	61.3	474.9
1925.....	36.3	47.4	17.2	835.1	60.8	507.7
1926.....	22.5	39.6	8.9	906.2	60.3	546.4

Year	Estimated Total Amount of Deposits Not Classified Subject to Check of All Banks, in Millions of Dollars	Year	Estimated Total Amount of Deposits Not Classified Subject to Check of All Banks, in Millions of Dollars
1917.....	2,263.8	1922.....	2,970.6
1918.....	2,195.2	1923.....	3,565.6
1919.....	2,828.0	1924.....	4,213.5
1920.....	3,716.1	1925.....	4,649.4
1921.....	1,387.1	1926.....	2,797.4

non-reporting banks may be made by applying their number as reported by the Comptroller to the averages of individual de-

posits of the reporting private banks. Then, by multiplying these figures for individual deposits of the non-reporting banks thus derived by the corresponding percentages of the unclassified deposits to the classified individual deposits of the private banks, we arrive at the estimate of the amounts of "deposits not classified" of the non-reporting banks. Next, by multiplying these estimated unclassified deposits by the corresponding percentages of the deposits subject to check to individual deposits of the private banks, we obtain figures for the checkable "deposits not classified" which should be in the non-reporting banks.

TABLE VI

ESTIMATE OF THE AMOUNT OF "DEPOSITS NOT CLASSIFIED" SUBJECT TO CHECK IN NON-REPORTING BANKS, 1917–26

Year	Estimated Individual Deposits in Non-reporting Banks, in Thousands of Dollars (1)	Percentage of Unclassified Deposits to Individual Deposits of Private Banks (2)	Estimated Deposits Not Classified in Non-reporting Banks, in Thousands of Dollars (3)	Percentage of Checkable Deposits to Classified Individual Deposits of Private Banks (4)	Estimated Checkable Deposits Not Classified in Non-reporting Banks, in Thousands of Dollars (5)
1917.....	489,590	9.3	45,532	58.2	26,500
1918.....	460,980	35.2	162,264	57.1	92,653
1919.....	527,886	35.5	187,400	38.4	71,962
1920.....	177,444	17.1	30,343	31.9	9,679
1921.....	84,205	11.2	9,431	45.5	4,291
1922.....	95,987	20.7	19,851	41.6	8,258
1923.....	90,906	33.3	18,818	33.7	6,342
1924.....	99,207	27.3	27,084	48.6	13,163
1925.....	105,492	28.6	30,199	47.4	14,314
1926.....	72,673	16.7	12,136	39.6	4,806

The final results are set forth in Table VII.

MONTHLY FIGURES—1914–26

The same general procedures that were employed in securing monthly figures for the amount of money in all banks are adopted here in the making of the monthly estimates for the amount of individual deposits subject to check. The Comptroller of the Currency publishes regularly in his annual reports and in the *Abstracts of Reports of Condition of National Banks* for three to six call dates each year figures showing precisely the volume of individual deposits subject to check of the national banks at dates of call. Provided that these banks are characteristic of the

TABLE VII

ESTIMATE OF THE DEPOSITS CURRENCY IN ALL BANKS OF THE UNITED STATES ON OR ABOUT JUNE 30, OF THE YEARS 1900–1926

Year	Individual Deposits Subject to Check in Reporting Banks, in Millions of Dollars (1)	Estimated Deposits Subject to Check in Non-reporting Banks, in Millions of Dollars (2)	Total Individual Deposits Subject to Check in All Banks, in Millions of Dollars (1)+(2) (3)	Exchanges for Clearing House of Reporting Banks, in Millions of Dollars (4)	Estimated Exchange for Clearing House of Non-reporting Banks, in Millions of Dollars (5)	Total Exchanges for Clearing House of All Banks in Millions of Dollars (4)+(5) (6)	Individual Deposits Subject to Check Corrected for Exchanges, in Millions of Dollars (3)−(6) (7)	Estimated Deposits Not Classified Subject to Check of Reporting Banks, in Millions of Dollars (8)	Estimated Checkable Deposits Not Classified in Non-reporting Banks, in Millions of Dollars (9)	Estimated Total Deposits Not Classified Checkable in All Banks, in Millions of Dollars (8)+(9) (10)	Final Estimate of Deposit Currency of All Banks, in Millions of Dollars (7)+(10) (11)
1900	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,205*
1901	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,955*
1902	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,367*
1903	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,540*
1904	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,853*
1905	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,559*
1906	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,863*
1907	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7,109*
1908	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,522*
1909	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,808*
1910	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	7,713*
1911	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,242*
1912	8,323.4	268.2	8,591.6	374.9	0.8	375.7	8,215.9	.....	.....	.....	8,216
1913	8,240.9	243.4	8,484.3	285.1	0.5	285.6	8,198.7	.....	.....	.....	8,199
1914	9,539.6	207.1	9,746.7	389.1	0.6	389.7	9,357.0	.....	.....	.....	9,357
1915	9,363.1	195.9	9,559.0	307.2	0.4	307.6	9,251.4	.....	.....	.....	9,251
1916	12,045.9	238.3	12,284.2	488.8	0.5	489.3	11,794.9	45.4†	.....	45.4	11,840
1917	10,632.3	257.9	10,890.2	486.1	0.8	486.9	10,403.4	2,263.8	26.5	2,290.3	12,694
1918	12,116.4	170.3	12,286.7	359.8	0.8	360.6	11,926.1	2,195.2	92.7	2,287.9	14,214
1919	14,721.7	130.7	14,852.4	831.7	0.9	832.6	14,019.8	2,828.0	72.0	2,900.0	16,920
1920	15,679.4	47.0	15,726.4	849.9	0.3	850.2	14,876.2	3,716.1	9.7	3,725.8	18,602
1921	16,074.1	34.0	16,108.1	1,049.5	0.1	1,049.6	15,058.5	1,387.1	4.3	1,391.4	16,450
1922	14,334.1	31.8	14,365.9	930.6	0.1	930.7	13,435.2	2,970.6	8.3	2,978.9	16,414
1923	14,248.4	20.3	14,268.7	646.6	0.2	646.8	13,621.9	3,565.6	6.3	3,571.9	17,194
1924	15,061.9	35.0	15,096.9	1,117.4	0.1	1,117.5	13,979.4	4,213.5	13.2	4,226.7	18,206
1925	16,563.2	35.6	16,598.8	1,227.0	0.2	1,227.2	15,371.6	4,649.4	14.3	4,663.7	20,035
1926	18,205.6	23.9	18,229.5	1,111.5	.....	1,111.5	17,118.0	2,797.4	4.8	2,802.2	19,920

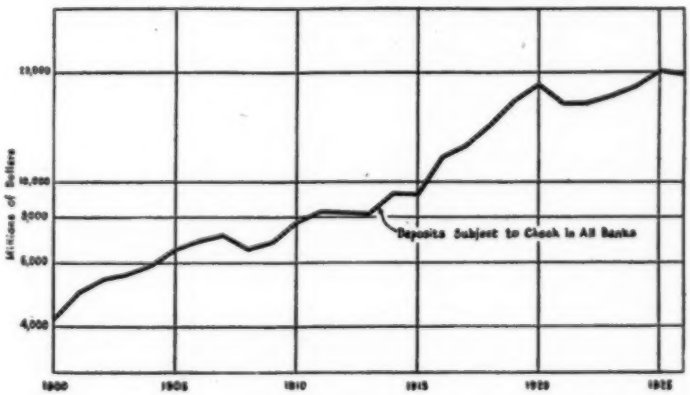
* Mitchell's *Business Cycles* (University of California Press, 1913), p. 321.

† Previous to 1917 the amount of deposits subject to check was not classified for the several classes of banks. Hence it is not possible to distribute the sum of 88.4 millions of dollars, the amount given by the Comptroller as the total of "deposits not classified" of all reporting banks for the year 1916, in the same way that the "deposits not classified" from 1917 to 1926 are distributed. The 45.4 millions are an estimate, computed by multiplying 88.4 by the average of the percentages of the figures for "deposits not classified" estimated to be subject to check of all banks (col. 8) to the corresponding figures for the total "deposits not classified" of all banks.

whole banking system, we can, with our single annual figure, interpolate on the basis of these national bank data as many figures as there are national bank calls, representing the amounts of individual deposits subject to check of all banks at dates of call. It is difficult to prove conclusively that the checkable deposit holdings of these banks are representative of the entire banking system, but such evidence as we have seems to point to that direction. The national banks contain on the average over

CHART I

DEPOSITS SUBJECT TO CHECK IN ALL BANKS, YEARLY, 1900–1926



50 per cent of the total deposits subject to check of all banks.[17] Since 1918 the Federal Reserve Board has been publishing in its monthly bulletins data concerning the condition of all the member banks of the Federal Reserve System for certain and, until recently, for all national bank dates of call.[18] Unfortunately for

[17] This will be demonstrated in a subsequent article.

[18] Previous to 1923 two calls each year are missing, usually the February and the September. In a letter replying to an inquiry made by me regarding the absent figures, the secretary of the Federal Reserve Board kindly informs me that in the years 1918–22, the Board called for condition reports from state member-banks less frequently than did the Comptroller from the national banks. Since 1923, the calls have been of equal frequency. Data concerning the condition of state member banks since the organization of the Federal Reserve System are also published in retrospective form in the *Annual Report of the Federal Reserve Board, 1926*, p. 146.

millions of dollars, the amount given by the Comptroller as the total of "deposits not classified for the several classes of banks. Hence it is not possible to distribute the sum of 88.4 posits not classified" from 1917 to 1926 are distributed. The figures are an estimate, computed by multiplying 88.4 by the average of the last three years for "deposits not classified" estimated to be subject to check of all banks (col. 6) to the corresponding figures for the total "deposits not classified" of all banks.

our purpose, however, figures for deposits subject to check are not given, and only those for "demand deposits" are available. In Chart II the demand deposits of all the member-banks of the Federal Reserve System and the deposits subject to check of the national banks are plotted. Attention should be called to the fact that the Federal Reserve System includes all the national banks and over a thousand state banks and trust companies. It is to be admitted that demand deposits are hardly comparable to de-

CHART II

COMPARISON OF THE DEMAND DEPOSITS IN ALL MEMBER-BANKS OF THE FEDERAL RESERVE SYSTEM AT DATES OF CALL WITH DEPOSITS SUBJECT TO CHECK IN NATIONAL BANKS AT DATES OF CALL, 1918–26

posits subject to check, since the former include something more than checkable deposits,[19] yet despite this objection, the two curves show remarkable agreement in their fluctuations.

Assuming, then, that the national-bank figures are representative, we can now compute our desired figures by applying precisely the same methods that were devised to secure similar figures for money for all banks. We need not enter into a discussion

[19] "Demand deposits" include "individual deposits subject to check," "certificate of deposits," "state, county or other municipal deposits," "deposits requiring notice," "dividends unpaid," and "other demand deposits." See Form 2130, "Report of Condition of National Banks" blank of the Office of the Comptroller of the Currency.

of the theory of the methodology or go into a description of the different procedures employed, inasmuch as we have dealt with both adequately elsewhere.[20] Suffice it to state that the trend of the national-bank series from June to June is removed and that

TABLE VIII

ESTIMATE OF THE AMOUNT OF INDIVIDUAL DEPOSITS SUBJECT TO CHECK OF ALL BANKS ON NATIONAL BANK DATES OF CALL OF THE YEARS 1914–26

Date of Call	Estimated Individual Deposits Subject to Check of All Banks, in Millions of Dollars	Date of Call	Estimated Individual Deposits Subject to Check of All Banks, in Millions of Dollars	Date of Call	Estimated Individual Deposits Subject to Check of All Banks, in Millions of Dollars
1913		1917—*cont.*		1921—*cont.*	
June 4	8,199	Nov. 20	14,093	Dec. 31	16,034
Oct. 21	8,615	Dec. 31	14,704	1922	
1914		1918		Mar. 10	15,509
Jan. 13	8,789	Mar. 4	14,342	May 5	15,825
Mar. 4	8,933	May 10	14,464	June 30	16,414
June 30	9,357	June 29	14,214	Sept. 15	16,677
Sept. 12	9,493	Aug. 31	14,833	Dec. 29	17,501
Oct. 31	9,109	Nov. 1	15,516	1923	
Dec. 31	8,161	Dec. 31	16,658	April 3	16,864
1915		1919		June 30	17,194
Mar. 4	8,582	Mar. 4	15,836	Sept. 14	17,626
May 1	9,210	May 12	16,963	Dec. 31	18,384
June 23	9,251	June 30	16,920	1924	
Sept. 2	9,576	Sept. 12	18,159	Mar. 31	17,625
Nov. 10	10,691	Nov. 17	19,106	June 30	18,206
Dec. 31	11,233	Dec. 31	19,035	Oct. 10	19,013
1916		1920		Dec. 31	20,121
Mar. 7	11,332	Feb. 28	18,458	1925	
May 1	11,819	May 4	18,539	April 6	19,082
June 30	11,840	June 30	18,602	June 30	20,035
Sept. 12	12,134	Sept. 8	18,895	Sept. 28	20,177
Nov. 17	12,975	Nov. 15	18,807	Dec. 31	21,387
Dec. 27	12,643	Dec. 29	17,749	1926	
1917		1921		April 12	19,622
Mar. 5	12,651	Feb. 21	16,787	June 30	19,920
May 1	13,013	April 28	16,291	Dec. 31	20,127
June 30	12,694	June 30	16,450		
Sept. 11	13,453	Sept. 6	15,881		

the purely fluctuating residues are applied to the trend of the all-bank series distributed on a straight line at dates of call. Thus, a new set of percentage figures or index numbers at dates of call is secured, and when these are applied successively to our annual

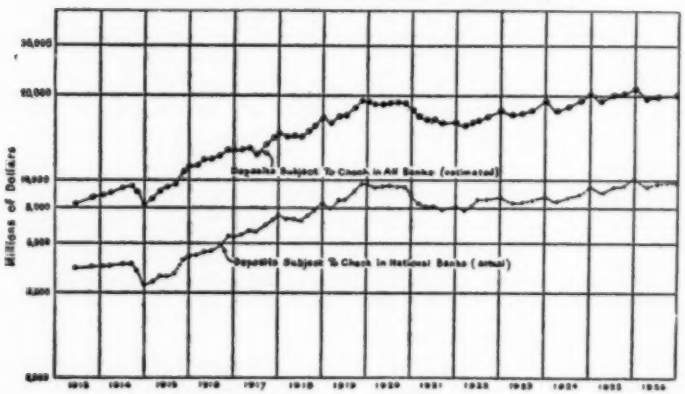
[20] The method of estimating used will be explained in a subsequent article.

figures showing the amount of checkable deposits of all banks on June 30 of each year, the following figures representing the volume of deposits subject to check of all banks at national-bank dates of call are derived. Both the actual national bank and the estimated all-bank series are plotted on Chart III.

There now remains for us the final task of interpolating from these figures on national bank dates of call monthly figures representing the amount of deposits subject to check on one day of

CHART III

COMPARISON OF THE ESTIMATED DEPOSITS SUBJECT TO CHECK IN ALL BANKS AT NATIONAL-BANK DATES OF CALL WITH THE ACTUAL DEPOSITS SUBJECT TO CHECK IN NATIONAL BANKS AT DATES OF CALL, 1913–26


Millions of Dollars
Deposits Subject To Check in All Banks (estimated)
Deposits Subject To Check in National Banks (actual)

each month. Since December, 1917, weekly data concerning the condition of some 700 member-banks located in leading cities are published regularly in the Federal Reserve bulletins. It is regrettable that figures for "demand deposits," instead of deposits subject to check, are alone available. It may be questionable whether we are warranted in utilizing the demand-deposit data of these banks to interpolate monthly figures for deposits subject to check for all banks. An inspection of Chart IV on which the estimated deposits subject to check of all banks at national bank dates of call and the demand deposits of the 700 member-banks in leading cities at dates of call nearest to those of the national banks are shown, will, however, put all doubts to

CHART IV

COMPARISON OF THE ESTIMATED DEPOSITS SUBJECT TO CHECK IN ALL BANKS AT NATIONAL-BANK DATES OF CALL WITH THE ACTUAL DEMAND DEPOSITS IN 700 FEDERAL RESERVE MEMBER-BANKS IN LEADING CITIES NEAREST TO NATIONAL-BANK DATES OF CALL, 1918–26

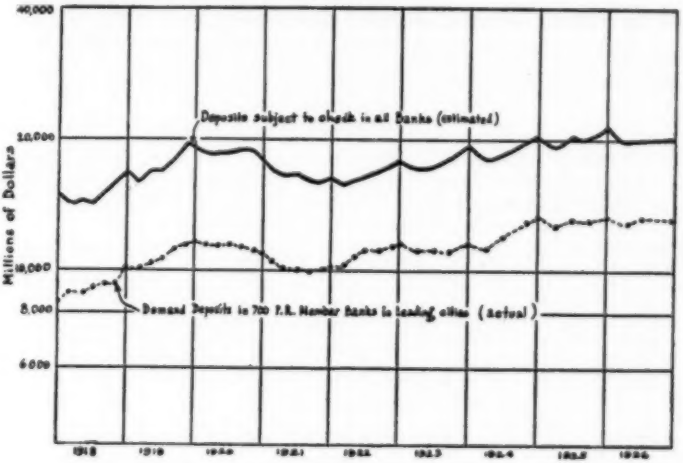
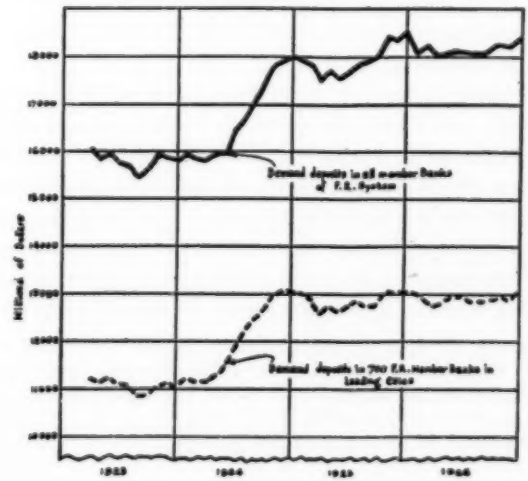


CHART V

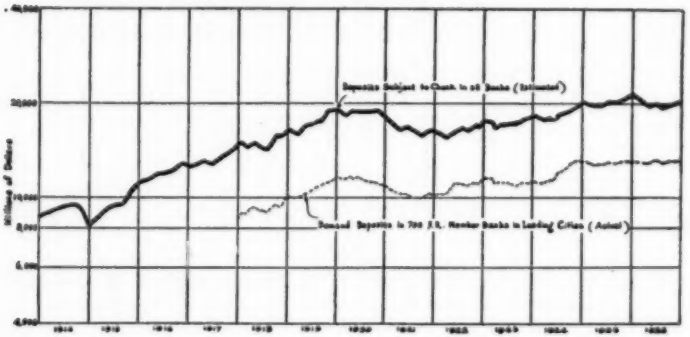
COMPARISON OF THE DEMAND DEPOSITS IN ALL MEMBER-BANKS OF THE FEDERAL RESERVE SYSTEM WITH THE DEMAND DEPOSITS IN 700 FEDERAL RESERVE MEMBER-BANKS IN LEADING CITIES, MONTHLY, 1923–26


Millions of Dollars
Demand deposits in all member Banks of F.R. System
Demand deposits in 700 F.R. Member Banks in leading cities

rest. Despite the incomparability of the two series, the two curves show surprising agreement not only in their fluctuations but also in their trends. Moreover, a perusal of Chart V, on which monthly data of the demand deposits of all member-banks of the Federal Reserve System[21] and similar data of the demand deposits of the 700 member-banks in leading cities are plotted, will further demonstrate that the 700 member-banks, so far as

CHART VI

COMPARISON OF THE ESTIMATED DEPOSITS SUBJECT TO CHECK IN ALL BANKS WITH THE ACTUAL DEMAND DEPOSITS IN 700 FEDERAL RESERVE MEMBER-BANKS IN LEADING CITIES, ON THE FIRST DAY OF EACH MONTH; ALL-BANK FIGURES, 1914–26; MEMBER-BANK FIGURES, 1918–26



their demand deposits are concerned, are indubitably representative of the Federal Reserve System and will still further justify the use of their demand deposit data as a basis of interpolation. Accordingly, the figures for demand deposits on dates of report nearest to the first of each month and nearest to the national-bank dates of call are compiled and used as a foundation upon which to interpolate monthly figures for individual deposits subject to check for all banks. The methods of interpolating the figures for the years 1918–26 are identical with those employed in computing monthly figures for money in all banks and are made

[21] Beginning on April 3, 1923, the Federal Reserve Board has been calling for reports of the volume of demand deposits of all member-banks of the Federal Reserve System for one day of the month, the date of call being identical with that nearest to or next to the nearest to the end of the month call of the 700 member-banks. The data are published regularly in the *Federal Reserve Bulletin*. (See July number of 1923, p. 795.)

familiar to the reader elsewhere. We shall therefore refrain from a description of the procedures by which we obtain the figures for 1918–26, which represent the volume of deposit currency in all

TABLE IX

ESTIMATE OF THE DEPOSIT CURRENCY OF ALL THE BANKS OF THE UNITED STATES ON THE FIRST DAY OF EACH MONTH, OF THE YEARS 1914–26

(In Millions of Dollars)

Month	1914	1915	1916	1917	1918	1919	1920
Jan.	8,762	8,161	11,233	12,643	14,704	16,658	19,035
Feb.	8,841	8,368	11,279	12,647	14,883	16,028	18,649
Mar.	8,922	8,555	11,322	12,651	14,342	15,800	18,458
April	9,029	8,880	11,548	12,819	14,787	16,026	18,777
May	9,138	9,210	11,819	13,013	14,979	16,629	18,641
June	9,248	9,231	11,830	12,850	14,383	16,860	18,771
July	9,357	9,251	11,840	12,694	14,214	16,920	18,602
Aug.	9,413	9,408	11,963	13,015	14,183	17,386	18,672
Sept.	9,470	9,566	12,086	13,339	14,833	17,467	18,642
Oct.	9,352	10,028	12,363	13,627	15,560	18,028	18,767
Nov.	9,109	10,529	12,759	13,910	15,516	18,805	18,818
Dec.	8,643	10,904	12,871	14,242	15,766	18,932	18,074

Month	1921	1922	1923	1924	1925	1926	1927
Jan.	17,749	16,034	17,501	18,384	20,121	21,387	20,127
Feb.	17,069	15,878	17,464	17,912	19,727	20,666	.....
Mar.	16,750	15,643	17,396	17,656	19,560	20,298	.....
April	16,433	15,355	16,677	17,625	19,272	19,770	.....
May	16,423	15,825	17,055	17,734	19,443	19,467	.....
June	16,677	16,268	16,980	17,488	19,521	19,748	.....
July	16,450	16,414	17,194	18,206	20,035	19,920	.....
Aug.	16,026	16,522	17,208	18,441	19,724	19,386	.....
Sept.	15,884	16,330	17,179	18,683	19,823	19,641	.....
Oct.	15,667	16,622	17,594	19,149	20,177	19,773	.....
Nov.	16,122	16,849	17,830	19,298	20,540	19,880	.....
Dec.	16,227	16,775	17,802	19,897	20,843	19,988	.....

banks on the first of each month.[22] The figures for the years 1914–17, for which monthly data of demand deposits are not available as a basis of estimation, are computed by means of straight-line interpolation.

Y. S. LEONG

COLUMBIA UNIVERSITY

[22] The methods of interpolation used will be explained in a subsequent article.

ECONOMIC EQUALITY AND THE MANDATES COMMISSION

THE common belief that the failure of effective application of the Open-Door principle in the past, especially in Africa, was due to the lack of any international supervisory body to ensure that such principle was carried out contributes to the interest in the relative success of the Permanent Mandates Commission under the League of Nations in maintaining economic equality for the nationals of League Members in the A and B mandated territories.

Economic equality, or the Open-Door policy as it is frequently called, may be defined as the guaranty to nationals of all or certain countries of equality of tariff treatment and, usually, the opportunity to compete for and participate in the sources of natural wealth, banking and industrial activities, state loans, and contracts for public works in a defined politically dependent area on an equal footing with the nationals of the country granting the privilege. More simply put, it is a policy of equal commercial opportunity and treatment for the nationals of all countries in colonial possessions and dependent territories. It is readily seen that this is a far different thing from free trade for, to quote Culbertson:

> The term "open-door" does not imply the absence of commercial restrictions and regulations; it seems to imply simply that import and export, port dues, or other charges shall apply equally and without discrimination to all countries alike, including the country in political control.[1]

Article XXII of the League of Nations Covenant, which deals with the question of mandates, came into existence only because of a compromise reached, after a serious impasse, which threatened the whole plan for a mandates system, between President Wilson and certain of the prime ministers of the British self-governing dominions. It was Wilson's idea that the system

[1] William S. Culbertson, *International Economic Policies* (New York, 1925), p. 266.

of mandates should apply to all of the German and Turkish territories which had fallen to the Allies during the war. Australia, New Zealand, and South Africa, on the other hand, were anxious to annex certain of the German territories in Africa and the Pacific islands. The compromise reached was the provision for Class C mandates, which were to be governed by these dominions as integral portions of their territories.[2] Most authorities on the formation of the Treaty of Versailles are agreed that had not President Wilson accepted this proposal, which virtually amounts to annexation, his whole idea for a mandates system under League control would never have come to pass.[3] It is for this reason that we do not find any provision made in Article XXII for economic equality in the Class C mandates.[4]

In the case of the Class A mandates, consisting of the former Turkish possessions, Syria, Palestine, and Mesopotamia (now Iraq), economic equality is guaranteed by the Covenant by implication only. Equal opportunities for trade and commerce of nationals of League members are guaranteed specifically, however, in the former German colonies of central Africa: Tanganyika, Ruanda-Urundi, Togoland, and Cameroons, the Class B mandates.

Article XXII further provides that ". . . . the degree of authority, control, or administration to be exercised by the Mandatory State . . . . shall be explicitly defined . . . . in a special Act or Charter."[5] All the mandatory powers have drawn up regulations for all of their mandates by which they are bound and which are in keeping with the provisions of Article XXII. These mandates texts, before they could go into effect, required approval by the Council of the League of Nations. In the case of the A and B mandates specific guaranties are included in the

[2] H. W. V. Temperley, *History of the Peace Conference of Paris*, II, 229–31; VI, 437–39. David Hunter Miller, *The Drafting of the Covenant* (New York, 1928), I, 101–17; "The Mandates System," *Foreign Affairs*, VI (January, 1928), 277–89.

[3] *Supra*. Cf. also R. S. Baker, *Woodrow Wilson and the World Settlement* (New York, 1922), I, 248–50.

[4] For text of Article XXII cf. Baker, *op. cit.*, III, 94–96.

[5] Baker, *op. cit.*, III, 94–96.

texts which provide for economic equality for nations of states who are members of the League of Nations. In general, it may be safely stated that these guaranties are virtually the same throughout all of the A and B mandates with but a few exceptions, which are outside the scope of this study.[6] The texts provide that the mandatory powers shall see that there is

> . . . . no distinction . . . . against the nationals . . . . of any State Member of the League of Nations as compared with its own Nationals or with the Nationals of any Foreign State in matters concerning taxation, or commerce, the exercise of professions or industries, or navigation, or in the treatment of ships or aircraft.[7]

It is further provided that concessions for the development of natural resources are to be granted without distinction of nationality between the nationals of states members of the League of Nations provided that they do not infringe upon the authority of the local government and are not in the nature of a general monopoly.[8]

Article XXII also provides that a Permanent Mandates Commission be established whose purpose will be to examine the annual reports which the mandatory powers are required to submit to the Council and to assist the League in ensuring the observance of the terms of the mandates. The Constitution of the Mandates Commission, in accordance with the last paragraph of Article XXII, was approved by the League Council on December 1, 1920.[9] It provides that the Commission shall consist

[6] The text for the Palestine mandate contains specific provisions designed to aid the Jews in establishing a national home. In the case of the Syria mandate certain types of concessions are open to League members which are not granted in the case of Palestine. There is practically no variance in the case of the B mandates. Cf. League of Nations, Permanent Mandates Commission, *Mandates Texts*.

[7] League of Nations, Permanent Mandates Commission, *Mandate for Syria*, Art. II.

[8] The United States has recently negotiated separate treaties with the A and B mandatory powers and has thereby obtained economic equality for our nationals in the A and B mandates, and with Japan for special privileges in Yap. Cf. *United States, Treaty Series*, Nos. 684, 690–91, 695, 704, 728, 743–45, and Quincy Wright, "The United States and the Mandates," *Michigan Law Review*, XXIII (March, 1925), 712–47.

[9] League of Nations, *Official Journal*, I, No. 8, 86–87.

of nine members,[10] the majority of whom must be nationals of the non-mandatory powers. The members are appointed for an indefinite term and must not be governmental representatives of the states of which they are nationals. The duty of the Commission is to "receive and examine the annual reports of the Mandatory Powers and to advise the Council on all matters relating to the observance of the Mandates."[11] Thus the Commission is an advisory body purely; it has not the power to render any decisions or to make direct recommendations to the mandatories. Since it may advise the Council, it is evident that the observations of the Commission form the basis for the decisions of the Council. The Commission examines and discusses each individual annual report in the presence of the duly accredited representative of the mandatory power, which offers any supplementary information demanded. Then, after the representative has withdrawn, the Commission decides on the observations to be submitted to the Council. These observances are communicated to the mandatory power, which is then entitled to add any comments of its own. Such comments are published simultaneously with the reports of the mandatory powers and the observances of the Commission.

Since the Commission is only an advisory body, and since the mandatory powers are all members of the Council and thus have the final word, the problem arises as to the best procedure available to the Commission for securing the desired information and for making recommendations to the mandatory powers, when necessary, through the Council. It is important, of course, that these be done without ruffling the feelings of the members of the mandatory powers on the Council. The Commission considered this question at its first session and resolved to devise a questionnaire which would serve as a guide to the mandatory powers in making out their reports. By this means the Commis-

[10] Increased to ten, September 8, 1927, upon Germany's entrance into the League.

[11] *Monthly Summary of the League of Nations*, Vol. V, No. 1 (February 15, 1925); W. R. Batsell, *International Conciliation*, No. 213, p. 294.

sion hoped to get all the information it desired on all points, including economic equality.[12]

By way of summary, then, the following methods are employed by the Commission in ascertaining whether the Open Door is being maintained in the A and B mandates: (*a*) the questionnaire; (*b*) the reports of the mandatory powers themselves; (*c*) questioning the accredited representative of the mandatory on specific points; (*d*) petitions sent to the Council by dissatisfied groups; (*f*) recommendations to the Council that it ask the mandatory power to supply additional information on the subject either in its next report or by special communications. Through these methods the Commission has sought, and successfully, to insure economic equality in the A and B mandates areas, and it has inquired, by these means, into such subjects as the following: concessions, customs tariffs, land tenure, state enterprises, postal rates in territories under A and B mandates, and purchases of supplies for the use of administrations and public works. There follows an examination of some of the questions that have arisen with respect to economic equality.

In the ninth session of the Commission the subject of different duties placed on ocean-going and coasting vessels for goods exported to or from Tanganyika came up, and one of the members raised the question whether this was in accordance with the principle of economic equality.[13] The Commission, however, on questioning the representative of the mandatory power, was convinced that the tax was only for a health certificate and thus of no importance. At the same session, another member noted that a survey was being made of the fisheries on the coast and he inquired whether the mandated territory would derive profit from this source. When informed by the representative that the natives would share in the enterprise, the Commission appeared satisfied that the principle of equality was being carried out.[14]

[12] *United States, Treaty Series,* Nos. 690–91, 695, 704, 728, 743–45. Permanent Mandates Commission (hereafter P.M.C.), *Minutes,* first session, pp. 37–39; 25–27; 29–32. Approved by Council, *ibid.,* second session, pp. 2–3.

[13] P.M.C., *Minutes,* ninth session, pp. 157–58. The question of economic equality arose as early as the first session; cf. *Minutes,* pp. 26–27.

[14] *Ibid.*

An example of apparent economic inequality in connection with the customs régime, which was quickly straightened out, was brought up during the eleventh session of the Commission, while that body was considering the report from Syria and the Lebanon.[15] The chairman, the Marquis Theodoli, pointed out to M. de Caix, accredited representative of the French government, that there had been some complaints that sometimes the subordinate customs officials "failed to recollect the principle of economic equality." M. de Caix replied that the high commissariat to Syria "would intervene as definitely as was necessary to ensure, on the part of the customs officers, that economic equality would be respected."[16] Whereupon the chairman closed the subject by adding that:

> It was only human that French Customs officers should have a certain preference for French goods but that the Chairman thought too highly of the services of the High Commissariat to doubt that the latter would in the future prohibit proceedings that were not in conformity with economic equality.[17]

When it is apparent that cases of inequality exist, the Commission in its "Observations" to the Council on the administration of the mandated territory will make a statement in its report similar to the following:

> The Commission noted that, by an order of May 10, 1921, the ordinance of February 17, 1921, embodying the Customs regulations for French Equatorial Africa, was extended to the Cameroons. . . . . It would appear as if preferential treatment had been accorded to the importation into the mandated territory of goods of French . . . . origin. The Commission would be glad to note in the next report that an amendment in the ordinances will have cleared up this point.[18]

Concessions and land-tenure also come in for their share of scrutiny, as well as customs tariffs. An example of the former is seen in the case that arose at the fifth session of the Commission relative to the Rutenberg electric concession.[19] The inquiry by the Commission began by one of the members noting that, while

[15] P.M.C., *Minutes*, eleventh session, p. 150.
[16] *Ibid.*
[17] *Ibid.*
[18] *Ibid.*, third session, p. 314.
[19] *Ibid.*, fifth session, pp. 84–86.

the Syrian mandate contained a clause prohibiting monopolies, there was no such clause in the Palestine mandate, and he wanted to know if any monopolies existed. When Sir Frederick Lugard, British member of the Commission, stated that the Rutenberg concession amounted to a monopoly and proceeded to expand on its value to Palestine, the Commission asked if the concession had been put up at tender since there had been a great deal of criticism. Sir Frederick replied in the negative, and added that it was not probable that there would have been any other bids.[20] The Commission inquired further concerning the monopoly and its relative advantages and disadvantages to the consumer. Since monopolies are permitted in Palestine the Commission made no comment on the case in its "Observations," for it has been careful to follow a policy of not commenting on the terms of the mandates themselves.[21] This case is cited merely to show the interest that the Commission takes in all phases of its work. Perhaps the thorough way in which the Commission goes about its duty may best be seen from the section of the questionnaire dealing with economic equality, copies of which were submitted to the mandatory powers to facilitate them in making their reports. The items in the questionnaire to the B mandatories which bear on the question of economic equality are as follows:

1. What provisions are made to secure economic equality as regards:
   a. Concessions?
   b. Land Tenure?
   c. Mining Rights (in particular, prospecting)?
   d. Fiscal régime (direct and indirect taxation)?
   e. Customs regulations (imports, transit)?
2. What are the exceptions, if any, in each category?[22]

In fact, the Commission was so thorough in the matter of its questionnaire that the mandatory powers finally brought the subject up at the meeting of the Council, September 3, 1926, and protested vigorously on the grounds that it required too much

[20] P.M.C., *Minutes*, fifth session, pp. 84–86. [21] *Ibid.*

[22] *Ibid.*, second session, pp. 81–82; for C mandates, pp. 83–84. On the basis of its experience, the Commission at its ninth session revised the questionnaires for B and C mandates drafted at its first session. The revision consisted of 118 questions against 46 on the original list. Cf. *Minutes*, ninth session, pp. 231–37.

administrative work to answer the queries.[23] Furthermore, the British member of the Council objected that it was being made to appear that the government was no longer vested in the mandatory power but in the Commission. The Council thereupon invited the Commission to reconsider the questionnaire in the light of the discussions and replies from the mandatory states on the subject.[24] However, the position taken by the Commission was that they were a body independent of the Council, designed to assist it, and it was "undeniable that, either in writing or, if the Mandatory Powers preferred it, verbally, the Commission remained free to put any question it liked concerning the administration of the mandated territories."[25]

An interesting sidelight on the concern taken by the Commission on the question of economic equality is its attitude toward the C mandates. Though the Open Door is not required in these areas, the Commission feels at liberty to inquire into cases in which it believes that it is not being observed, though not in any spirit of criticism but purely for the sake of enlightenment. With what tact such information is sought is shown by this typical conversation with respect to the Japanese mandate in the Pacific as recorded in the *Minutes*:[26]

> M. Rappard observed that the Mandate under consideration was a C Mandate and that the Mandatory was not required to respect the principle of economic equality. His observations were not inspired in any spirit of criticism. . . . . M. Rappard said that he was not making any criticism. He merely wished to note that the foreign commerce of the islands was virtually restricted to commerce with Japan.[27]

Several incidents bearing on the question of economic equality in the C mandated areas have been inquired into by the Mandates Commission. One of these concerns the phosphate concessions in Nauru; another, a shipping act of the Australian government which was extended to include New Guinea; and a third

[23] League of Nations, *Official Journal*, VII, Part II (1926), 1233 ff.

[24] *Ibid.*

[25] P.M.C., *Minutes*, tenth session, p. 14.

[26] *Ibid.*, pp. 21–22.

[27] *Ibid.*, p. 41.

has to do with the extension of the tariff schedules of the Union of South Africa to apply to mandated territory of German Southwest Africa. These cases reveal the significant fact that while economic equality is not provided for in the C mandated areas, nevertheless the Mandates Commission intends to keep informed as to acts of mandatories affecting the economic development of the native peoples in these areas.

What appeared on the surface to be a clear case of the control and exploitation of a natural resource by a mandatory power was brought to the attention of the Mandates Commission during its second session in August, 1922, when the question of the Nauru phosphates concessions was raised by a member of the Commission, and Sir Joseph Cook, representative of the mandatory, was asked about the ownership of the deposits.[28] Sir Joseph explained that the rights to the deposits had been transferred from the German company who possessed them before the war to the Pacific Phosphate Company, and were then purchased in 1919 by the governments of Great Britain, Australia, and New Zealand, who in turn vested the control of the works in the British Phosphate Commission. The purchase price was approximately $16,000,000. He further explained that the British Phosphate Commission is composed of three members, one from each of the governments concerned. It is not to be confused with the administrator appointed by Australia, who is actually the government of Nauru, since he possesses legislative, judicial, and executive powers. The central theme of the defense put forth by Sir Joseph was that the three governments concerned had bought their rights from the British Phosphate Company and that they did not seek to derive any profit from the monopoly, but only to meet their own requirements and then place the remainder of the supply on the open market.[29] At the same time the Commission inquired whether the natives were deprived of the lands that contained mineral deposits, and they were apparently satisfied

[28] William Culbertson, "Raw Materials and Foodstuffs," *Annals of the American Academy*, CXII (March, 1924), 70–73; P.M.C., *Minutes*, second session, pp. 37–38.

[29] *Ibid.* Cf. also F. D. Lugard, *The Dual Mandate in British Tropical Africa* (London, 1926), pp. 52–53.

when Sir Joseph stated that the natives were paid about $45 an acre for such land, besides being given royalty on all phosphates removed.[80] In the case of Nauru, the Mandates Commission had to acknowledge that the right of exploitation of the phosphate deposits had been acquired by the payment of a large sum to its possessors before the mandate had been conferred. The Commission appeared satisfied with the explanations offered.

In its observations to the Council following its sixth session, June 25 to July 10, 1925, the Commission noted that the extension to New Guinea of the Australian Navigation Act, by which shipping to the mandated territory was confined to Australian vessels, had the effect of seriously hampering the economic development of New Guinea.[81] This question came to a speedy settlement and was one that pleased the members of the Mandates Commission and, furthermore, received favorable comment in the Sixth Committee of the Assembly. At the opening of the seventh session of the Commission, a telegram was received from the Australian government to the effect that the application of the navigation law to New Guinea had been discontinued from September 1, 1925.[82]

Although the question of the extension of customs tariffs of the Union of South Africa to the Southwest African Mandate was somewhat outside the immediate concern of the Commission, since the mandate in question is of the Class C type and is therefore for all practical purposes an integral portion of the Union of South Africa, certain of its members have taken occasion to inquire from the representative of the mandatory whether for customs purposes the mandate territory was included in the Union of South Africa. Furthermore inquiries, solely for the sake of information, have been directed as to the method employed in the extension of the customs tariffs to include the Southwest African Mandate.[83]

[80] P.M.C., *Minutes*, second session, pp. 38–41.

[81] *Ibid.*, sixth session, pp. 87–88, 179–80.

[82] *Ibid.*, seventh session, pp. 8–9.

[83] *Ibid.*, second session, pp. 27–28; third session, pp. 110–11; ninth session, pp. 40–41.

One of the most troublesome problems faced today by the Commission in regard to economic equality is the question of postal rates. This originated during the ninth session of the Commission, while it was discussing the report from Tanganyika with the representative of the mandatory.[34] At this time the chairman of the Commission asked if there were not an international convention by virtue of which the postal rates were different in Tanganyika according to whether letters were sent to British possessions or to foreign countries. The representative of the mandatory power promised to furnish this information to the Commission. During the twelfth session of the Commission the mandatory was presented a reply which showed that rates of postage for matter destined for British possessions have been assimilated to the inland rates of the territory.[35] The question became a tangled one, as members of the committee disagreed as to whether letters were articles of commerce and thus forbidden to be assimilated under the terms of the draft mandates. Furthermore, it became an important problem when it was brought to the attention of the Commission that not only in Tanganyika but also in other mandate territories as well there existed one set of rates for "foreign countries and a lower rate to matter destined for the Mandatory Power's own territory, either in Europe or elsewhere."[36] Since the members of the Commission were not able to agree among themselves as to the course of procedure, the question was postponed for a later date in the same session. The result of the difference of opinion in the Commission was the drafting of a compromise statement which was included in the observations sent by the Commission to the Council which read, in part as follows:

> The Commission's attention has been again directed to the question of postal rates in the territories under A and B Mandates. . . . . The Commission, whose members expressed views, has been considering whether this practice is quite consistent with the strict application of the principle which it must do everything to uphold. . . . . The Commission proposes . . . .

[34] *Ibid.*, ninth session, p. 148.

[35] *Ibid.*, twelfth session, pp. 67–70.

[36] *Ibid.*, twelfth session, pp. 160–62, 170, 198.

that the Council should request the Mandatory Powers . . . . to furnish particulars concerning:

1. Their system of postal rates;

2. The reasons which have led them to adopt different rates;

3. The practical importance of the question from the financial point of view.[37]

The request was approved by the Council in March, 1928, and, as the chairman noted during the thirteenth session, it was too soon for the available information to be supplied during that session.[38] However, the question arose again during the same session of the Commission while the examination of the report for Syria and the Lebanon was in progress.[39] At this time the chairman again felt that the régime in Syria as regards postal matters was contrary to the principle of economic equality. It was decided to suspend further action until the replies had reached the Commission.

Another question of a similar kind which has vexed the Commission is that of the purchase of supplies by or for the use of administrations of the mandated territories in the mandatory state exclusively. This came up at the eleventh session of the Commission and was directly inspired by a debate on the subject held in the English Parliament, December 9, 1926.[40] The discussion in Parliament, on the point whether purchases of certain machinery and equipment out of a certain loan guaranteed by the British government could be restricted to the British empire and still be within the provisions of the draft mandate for Tanganyika, was echoed in the meetings of the Commission,[41] at its twelfth session. Since no agreement could be reached on the various points, it was referred to the thirteenth session. The Commission reached a point of compromise when it was proposed that more information be sought on the facts of the case.

[37] *Ibid.*

[38] *Ibid.*, thirteenth session, pp. 14–15, 93–95.

[39] *Ibid.*, pp. 171–72.

[40] *Ibid.*, eleventh session, pp. 78–80.

[41] *Ibid.*, twelfth session, pp. 63–67, 164–69.

The following text appeared in the report to the Council on the work of the thirteenth session of the Commission:

> The Permanent Mandates Commission recommends to the Council that it should request the Mandatory Powers to be entrusted with the administration of territories under A and B Mandates to furnish information on the following point: What regulations have been adopted or are generally followed by them when supplies are purchased by the public authorities of the Mandated territories?[42]

The result of the questionnaires sent out by the Council to the mandatory powers concerning postal rates and the purchase of supplies is not yet known. The past record of the Permanent Mandates Commission gives ground for confidence that it will continue to safeguard the principle of economic equality, and that the Open Door will be kept open to nationals of League members as well as to nationals of the United States.

EDWARD C. JENKINS

UNIVERSITY OF CHICAGO

[42] *Ibid.*, thirteenth session, pp. 224–25.

BOOK REVIEWS

Monnaie et Industrie. By ALBERT AFTALION. Paris: Recueil Sirey, 1929. Pp. 262.

This is a collection of articles written in 1927 and 1928 and now revised. They relate to questions of the day, "les grands problèmes de l'heure présente." Several articles deal with monetary stabilization in France and the movements of capital connected therewith. Other subjects are price stabilization, the interpretation of price statistics, business forecasting, the organization of French industry. A concluding article on the dangers of Socialism does not harmonize very well with the objective and technical treatment of the other subjects.

Professor Aftalion is one of the foremost of French economists, and his readers will enjoy the application of his acute and suggestive thought to current questions.

In the case of the monetary reforms in France he is chiefly concerned with the interpretation of events. Why was there so great an influx of foreign exchange in 1927–28?

In a chapter on French savings and industry M. Aftalion approaches this question from the standpoint of movements of capital. He relies on statistics of capital issues and of the balance of trade.

It is not very easy to draw trustworthy inferences from the statistics of capital issues in France since the war. Issues by the government are a large proportion of the total, and their significance depends on the extent to which they have been subscribed from real savings as contrasted with the creation of bank credit. When M. Aftalion says that "the contrast was striking between the apparent savings of 120 milliards for 1919–21 and those of 2 or 3 milliards for 1925–26" (p. 192), he arrives at his figures by attributing to the government a net sum for the excess of borrowings (long and short term) over repayments. That net sum was for 1925 a *negative* quantity of 6½ milliards (p. 189).

By apparent savings he means savings applied to capital outlays *in France,* and he draws the inference that there was a large importation of capital in 1919–21 and a large exportation of capital in 1925–26. Even though the figures of capital issues do not supply a very reliable support for this conclusion, it could be derived independently from the statistics of imports and exports. For France at the present day it is probable that there is a regular surplus of invisible exports on

current accounts to the amount of several milliards so that if there were no export or import of capital the visible trade would show an equivalent surplus of imports. Consequently the export surplus of 1¾ milliards for the two years 1925–26 implies a substantial export of capital for those years.

M. Aftalion explains this as a "flight of capital," due to distrust of the franc. In 1927 there was an export surplus of 2½ milliards. This by itself points to an increased export of capital. But that is far more than accounted for by the vast acquisition of foreign exchange by the Bank of France. After allowing for that, the operations of the public must have amounted to an ***importation*** of capital to the extent of tens of milliards.

This phenomenon Professor Aftalion attributes partly to the "return" of the capital which fled abroad in 1925–26, and partly to foreign speculative purchase of franc securities. Here he is echoing the opinions of the market-place. "There is no doubt that a great part of the foreign exchange acquired by the Bank of France represents returned capital, though no precise information exists or can exist on the subject" (p. 211). The absence of "precise information" might well have led so scientific an economist to admit doubts which his informants did not feel.

People in the world of practical finance are very apt to misunderstand the process loosely described as "flight of capital." If the holders of franc balances and franc securities were impelled by distrust to unload in the critical years 1925–26, they must have found *buyers* to unload upon. The whole volume of transactions described as a flight of capital *from* France, might equally well be described as a flight of capital *to* France, for the purchases of franc securities would be equal to the sales. The distrust would be reflected in the low valuation of the franc at which the equilibrium of purchases and sales is maintained.

Therefore the flight from the franc is likely to be restrained within modest dimensions by the difficulty of finding buyers of francs. Its effects upon markets will be chiefly felt in (1) an accumulation of franc balances in the hands of dealers in foreign exchange and (2) to a suspension of new issues of franc securities. The increase in franc balances that the dealers will tolerate would be inconsiderable. As to franc securities, it is only fixed interest securities, not ordinary shares, that will be affected. How, then, can there be a "return" of capital from the flight on any considerable scale? If there is a repurchase of franc securities, there must be sellers equivalent to the buyers. But

there may be a fresh supply of franc securities. In fact, just as the most substantial part of the flight of capital takes the form of a suspension of the issue of franc securities, so the return of capital takes the form of a favorable market for franc securities. And, in order to materialize, it needs a fresh supply of those securities.

"There was a period when the francs issued by the Bank against the foreign exchange purchased regularly returned to it. But how did this return come about? Through loans to the State in almost every case" (p. 205).

It was the revived confidence in the franc that enabled the state to float these loans (p. 19). But that was not the whole story. When *de facto* stabilization was started in December, 1926, the note issue was 53 milliards. Thereupon there appeared "that almost superstitious terror of inflation, which is so frequent in France" (p. 16). The borrowing operations of the government were directed to keeping down the note issue. As fast as the note issue increased, the government swept up the additional notes from the market by issuing loans.

But as Professor Aftalion shows, more notes were *needed*. The experience of Germany, Austria, and Hungary had illustrated the general principle that a revival of confidence in a currency involves an increase in the circulation (pp. 16 and 17). Discredit involves a flight from the currency; people reduce cash balances below normal limits. The return of confidence leads them to replenish balances. The French government and the Bank of France were unable between them to counteract this tendency. The note issue expanded early in 1928 to 60 milliards. Professor Aftalion points out that this is really a relatively smaller supply of currency than the country had before the war (p. 17), (and the same may be said even of the 64 milliards to which the circulation has since risen).

Given these conditions, it is quite unnecessary to determine whether capital returned from its flight or not and whether there was an extensive speculation for a rise in the franc or not. The government and the Bank of France were at cross-purposes. The government was keeping down the note circulation by borrowing and withdrawing the proceeds of its loans in notes from circulation. The bank was issuing notes to all comers against foreign exchange at a fixed price of just under 4 cents to a franc. As fast as the government borrowed and extinguished notes (by repaying its indebtedness to the Bank of France or accumulating its own balances on deposit with the bank), the gap in the circulation was made good by the increase in the bank's holding of foreign exchange.

When the government came to the end of its borrowing, the bank itself tried to keep down the note issue by selling foreign exchange forward *(reports)*.

The bank's practice was to sell spot exchange and simultaneously to buy an equal amount forward. Essentially it was *lending* pounds or dollars, and at the same time *borrowing* the equivalent in francs. The bank was in fact taking over from the government the function of sweeping up the redundant francs.

But these measures could not long prevail against the underlying need for more currency. Professor Aftalion attributes the depression which accompanied the stabilization of the franc to the fall of prices which started in the middle of 1926, and to the lag of costs behind selling-prices (pp. 47–49). But the process of reconstituting necessary cash balances is itself a cause of depression. If credit is freely created, so that the increased cash is backed by increased bills or advances to traders, the tendency to depression is counteracted; the additional cash is accumulated without any shrinkage of demand. But if the creation of credit is obstructed, that is not so.

Consumers who are short of ready cash restrict outlay; velocity of circulation declines; demand flags; goods that cannot be sold at home have to be sold abroad, and cash is provided by the sale of the resulting foreign exchange to the central bank. When the government or the central bank withdraws the cash by borrowing operations, the revival of demand is prevented and the depression is prolonged. Very low rates of short-term interest, such as prevailed in France in 1927, are the normal accompaniment of business depression. The depression itself facilitated the borrowing operations which contributed to cause it.

The real cause of the influx of foreign exchange in 1927 and 1928 was that the decision to peg the franc at 3.92 cents and the decision to keep the note issue down to 53 milliards were *inconsistent with one another*. With the note issue so limited, the franc was undervalued, and a favorable balance of payment was caused, and the consequent influx of foreign exchange would soon have raised the note issue to a suitable amount, but for the intervention of the government. The intervention of the government, by delaying the expansion of the note issue, involved a *much greater* influx of foreign exchange, the excess taking the form of an *influx of capital* in response to the government borrowing.

Professor Aftalion devotes a chapter to price stabilization. On this question his attitude is extremely cautious. He throws doubt on

the effectiveness of the control of credit by the Federal Reserve System as a stabilizing factor since 1922. On the contrary,

> there has perhaps been a less energetic intervention on their part to restrict credit than in earlier cycles. If so, is it not because their intervention has been less necessary? Are not the reasons for the approximate stability of prices in the United States to be sought outside the influence of the banks? [p. 101].

I think Professor Aftalion has fallen into an error very prevalent among the critics of plans for the stabilization of prices. He is impressed by the difficulty of counteracting through credit measures "the brilliant perspectives of profit in the periods of rapidly rising prices and the fears of heavy loss in the periods of falling prices" (p. 108). He forgets that the policy of stabilization aims at *preventing* such movements. The difficulty of *correcting* them arises when credit is regulated (as under the pre-war gold standard) without regard to the price level, or when the stabilization plan is for any reason unsuccessful.

On the other hand, he points out very pertinently that the Federal Reserve System cannot control the price level at will, now that the gold standard has become international, and that low discount rates in America could not raise the world price level in face of credit pressure in England and elsewhere (p. 106).

R. G. HAWTREY

CAMBRIDGE, MASSACHUSETTS

Banking Standards under the Federal Reserve System. By HORACE SECRIST. Chicago and New York: Published for the Bureau of Business Research, Northwestern University, by A. W. Shaw Company, 1928. Pp. xxxviii+420.

It is to be feared that Professor Secrist's brave venture into the field of the investigation of *Banking Standards under the Federal Reserve System* will be greeted by many of the criticisms which have been directed against the products of our institutes of economic and business research, whose achievements up to the present, with a few notable exceptions, have been more than once characterized as disproportionately small in comparison with the very large financial outlay involved. It will be seriously doubted, for one thing, whether general statements of the type presented by Professor Secrist as "major conclusions" can really claim to be "results" at all, in any significant sense of the word. Of what real interest for future investigation

in the field, for example, is the achievement of what Professor Secrist characterizes (p. 7) as the "major purpose" of his study, viz., the "discovery" of "conclusive evidence of *order* in our banking system," as well as evidence of "the processes of competitive effort in a competitive system"? Or the "discovery" that certain ratios chosen for examination are "found to be functions of operating conditions" (p. 277)? On the other hand, a large part of those of Professor Secrist's results which are phrased in fairly concrete terms can hardly be regarded as adding in any significant way to what we already know: as when we are informed, for example, that the results of the study indicate that our banking system is possessed of a certain "unity and competitive character" (p. 347), "its several parts responding in much the same manner to change, and its several processes being interrelated in a definite manner" (p. 7).

Professor Secrist would probably accept as a fair characterization of most of his work the statement that it was concerned chiefly with the task of "observing the uniformities, and generalizing as to their preponderance" in the data under discussion (p. 153). The trouble with such generalizations, of course, lies not so much in the fact that in some cases Professor Secrist's own findings do not seem always to justify the proposition as to the preponderance of uniformities over differences, as it does in the fact that such a statement of findings implies that the mere recording of facts, whenever the facts are found to disclose a certain degree of "uniformity," takes on a degree of scientific importance approaching that which attaches to explanation, the latter being accorded by Professor Secrist a treatment which can only be described as step-motherly. This implication is the more unfortunate because Professor Secrist has allowed himself to slip into modes of expression (e.g., p. 7) which would suggest an unwarranted confidence in the predictive value of results for which, at other points (e.g., pp. vii, 341) the author himself does not claim more than that they represent a description of tendencies discovered empirically for a given historical period.

The chief sin of omission in Professor Secrist's study, and the one which is most disturbing to those who, like the present reviewer, continue to cherish a faith in the ultimate possibilities of institutionalized research, would seem to follow from a failure to recognize that theory, in the strict sense of the term, finds its most fruitful union with statistics not merely in the "verification" of historical hypotheses, but in the measurement, through the use of statistics, of the relative strength

of forces whose relevance for the problem in hand it is the province of theory to discover. In the study under review, there are only a few scattered instances (e.g., pp. 256 ff., 325 ff.) of attempts to measure the relative strength of forces whose union will produce a given result: and even here the tentative and groping method of attack, and the entirely subordinate place which these instances fill in the whole treatment, have the effect only of intensifying our regret that the possibilities of this type of project were not more thoroughly canvassed by Professor Secrist and his co-workers. Such a criticism finds the more justification because of the fact that a large part of the study under review represents a diversion of effort which might just as easily have been devoted to significant and important tasks, to an elaborate re-working of the data in ways that add virtually nothing to the results already obtained: as in the statistical re-working of identical material to bring out results which should have been self-evident on the basis of work done at other points in the study, or in the statistical manipulation of material toward results of which it should have been known in advance that they were bound to be virtually meaningless.

A. W. MARGET

UNIVERSITY OF MINNESOTA

Industrial Combinations and Public Policy. By MYRON W. WATKINS. Boston: Houghton Mifflin Co., 1927. Pp. iii+331.

Mr. Watkins examines the tendency to industrial combination from three points of view: the causes and consequences of combination, experience of combination in sample industries, and public policy in relation to the movement.

Taking a sweeping historical view he finds a rhythm in the changes in the degree of industrial control as the adventurous opening up of new markets gives place to their vigorous exploitation, which, in its turn, gives rise to more settled forms of business. In this general setting he sees the combination movement in the United States, giving perhaps too little emphasis to the recent great changes in the technique of production and marketing. In this movement the promotion of efficiency in the production and distribution of goods has been at the most a secondary motive. Critical of the alleged economies of combination, he denies to integration any economic basis, although in nearly every business the integration of a series of processes enters, based on

economies of handling or overhead or the more effective synchronization of different stages of production.

The discussion of the net effect of monopolistic control of production upon the welfare of the community, by way of a series of diagrams based upon curves of marginal price offer and marginal cost, suffers from the failure to relate its assumptions sufficiently closely to practical conditions. While in the absence of any knowledge of the nature of the differences in the marginal utility of money to different people, simplicity of presentation necessitates the assumption that money is of equal marginal utility to all people, the full significance of the assumption calls for emphasis. In particular it is evident that public opposition to monopoly is based not only upon the ground that it diverts resources so as to diminish the total volume of production, but also on the belief that it diverts goods and services from those who receive smaller to those who receive larger incomes. Moreover Mr. Watkins argues that differences in the marginal utility of money and of resources do not seriously obstruct the effectiveness and economy with which the disposable economic resources of the country are used, because "the producers and consumers of different products are 'random' samples of producers and consumers in general" (p. 100). But the consumers of yachts are not such a random sample of consumers in general, and, therefore, the criterion of effectiveness in the disposal of resources implies the acceptance of the existing distribution of incomes. Mr. Watkins passes on with a question whether any of us is vain enough to believe that he could devise a distribution of goods and resources that would be better than that secured in the market (p. 99).

The discussion of the practical experience of combinations is chiefly interesting for the technique of testing combinations that is employed. The formation of the International Harvester Company and the United States Steel Corporation is attributed to the desire to obtain "advantages in the marketing of products as a result of diminished competition" (p. 119). Because the proportion of the total of their respective industries which is in the hands of each of these firms has declined, it is inferred that "the size and power of these combinations could not have been attained by sheer force of superiority" (p. 127). But unless a firm is declining in absolute volume of business it is arguable that it may be of optimum size for the industry and, for that very reason, it might be expected not to expand at the same rate as the industry as a whole.

To the Harvester Company Mr. Watkins applies the admittedly

crude test of earnings in relation to assets (valued upon a rough replacement cost basis) and concludes (p. 134) from the fact that the rate of profit has been on a roughly "competitive" basis in an industry, not unduly risky, and run with only average competence, that the prices it has obtained for its products have not been unduly high. But, in view of the earlier emphasis upon the formation of the company out of non-competitive considerations, the ability of the company to pay profits on a "competitive" level on all the assets of an uneconomically large corporation suggests that its prices have in fact been too high.

The achievements of the steel corporation are tested by calculating for certain branches of the industry the relation between the amount paid to property and the amount paid to both property and labor. The exercise of monopoly power might be expected to evidence itself in an increase in the proportion going to property. But, while there was a sharp increase between 1889 and 1899, there was a sharp decrease between 1899 and 1914 in both steel mills and blast furnaces. Thus any attempt to exert monopoly power has been neutralized by other influences. Mr. Watkins interprets this result as suggesting that the corporation may have run off its profits into the departments producing raw materials, an interpretation which would suggest that this particular test is, therefore, inapplicable. But he proceeds to state that there appears to have been no advance in the technique of steelmaking for the last two decades and to attribute the absence of any such advance, at least in part, to the policy of the corporation. This conclusion does not follow from the statistical evidence adduced, and in any case the survival of the corporation might be the consequence and not the cause of the absence of technical advance. But the recent investigations made under the auspices of the United States Department of Labor fail to support the suggestion that there has been little technical advance in the industry. The increase of nearly 100 per cent in the output per man-hour of merchant blast furnaces between 1920 and 1926[1] indicates that, during the last seven or eight years at least, considerable changes in the technique of production have been made.

A vigorous and clear summary of social policy in the past as it has appeared in the common law, the statutes, and the conduct of the executive and judicial arms of the state leads to the consideration of the desirable policy for the future. Mr. Watkins favors the extension of state action in the direction of attempts to raise the plane of competition: the powers of the Federal Trade Commission should be extended

[1] *Monthly Labour Review*, 1928, p. 1075.

and the secrecy of the business man attacked. At this point the book ends with the comment that to follow the visionaries who demand unrestricted freedom, or the cynics claiming the exercise of unlimited authority, would be equally unsafe. By resting his whole policy upon the plea for a higher plane of competition and failing to offer any guidance in determining what kinds of conduct shall be regarded as on a high plane of competition, Mr. Watkins scarcely lives up to his promise "to make the reader realize he was being taken somewhere" by a guide "who knew where he was going" (p. v). He has done no more than state the problem—that of determining the kinds of behavior we desire and can reasonably expect from business men in the conduct of their businesses and especially in their price and production policies.

ARTHUR R. BURNS

COLUMBIA UNIVERSITY

Evolution of the English Farm. By M. E. SEEBOHM. Cambridge: Harvard University Press, 1927. Pp. 376.

This is a satisfying book. At its conclusion the reader feels that he has in reality traversed the ages with the tiller of English soil and has witnessed his conquest of improved methods by a process so slow that the mere patient narration of it leaves a deep sense of the almost timeless endurance of this "most ancient occupation of mankind."

This is not a history of English agriculture but of the English farmyard. It concerns itself with the life of the farmer from day to day, his dwelling and outbuildings, his food and drink, his wife and her activities, his hired helpers, his animals, his tools, his methods of ploughing, reaping, and winnowing, his knowledge of grains, vegetables, poultry, and bee-keeping, his relation, most often humble, to the greater ones in the rural economy, his practical arrangements for the use of the soil, for many centuries as a member of a co-operative undertaking, then as independent owner, tenant, or simple laborer.

Each of these aspects of agricultural life is dealt with, if pertinent, in connection with each of the long periods into which the history falls—the Neolithic, the Bronze, and the Early Iron or Celtic age, the Roman and Saxon periods, the period from the Norman Conquest to the Black Death, 1348 to 1500, and the four subsequent centuries, each treated as a unit. Such repetition of topics permits detailed comparison of one age with another. The steps by which the changes were brought about are barely indicated. There is little explanation of

causes but rather the terse setting forth of concrete facts drawn mainly from contemporary sources. Underneath this simplicity of treatment are evident, however, accurate knowledge and much scholarly investigation. Descriptions in the words of contemporaries, drawings from contemporary works, and sketches of tools and implements add to the air of reality the book possesses.

It would be possible to mention numerous topics that might have found a place in the study. Contentious topics are not discussed, though the problem is usually stated in clear terms, as, for example, with regard to the extent and nature of Roman influence, the social effects of inclosures, and the relative value of the large and the small farm. Instead, however, of pointing out subjects that might have been included it is more profitable to commend the original contribution made by this book. This lies in its detailed descriptions of the practical side of English rural life as lived from age to age. The descriptions are achieved by means of facts, not adjectives. The result is not a tedious book but a charming one.

The bibliography is extensive, though the absence of all *Blue Books* is noted and even of the valuable publications of the semiofficial Board of Agriculture around 1800. Among modern authors it is surprising to find Gilbert Slater and E. C. K. Gonner omitted. And it is strange bibliography-making to omit most of the dates of publication.

FRANCES E. GILLESPIE

UNIVERSITY OF CHICAGO

Étude sur l'Histoire Économique de l'ancien Japon des origines à la fin du XII^e siècle. By M. YOSHITOMI. Préface de M. MICHEL REVON. Paris: A. Pedone, 1927. Pp. viii+263.

Mr. Yoshitomi, a licentiate of the Imperial University of Tokyo, and a Doctor of Laws and Doctor of Letters of the University of Paris, is one of the ablest of the younger Japanese historians. He is also an attaché of the Japanese Ministry of Foreign Affairs. As an editor, translator, and historian he is favorably known in France as well as in his native country. Several of his publications have been done in collaboration with M. Albert Maybon. Among his earlier works published in French or in Japanese are *La psychologie des peuples et l'évolution des civilisations* (in Japanese) (Tokyo, 1921); *Le Japon et sa civilisation* (Grenoble, 1923); *Les Conflits nippo-américains et le Problème du Pacifique* (Paris, 1926).

The work under review is a dissertation presented to the faculty

of the University of Paris for which the writer received the degree of Doctor of Letters. In three parts and ten chapters is traced the economic organization of Japan from the earliest times to the foundation of the *Bakufu* at the close of the twelfth century. Part I treats of the people and society of old Japan; Part II with the economic institutions of the period; Part III with the economic life of the outstanding social groups. By fact and hypothesis the formation of the Japanese people is first analyzed, the migrations of Ainus, Chinese, Koreans, and Malays being outlined. The author's interpretations of Japanese mythology—especially those having to do with the divine ancestors of the reigning family—are scarcely calculated to endear him to the extreme imperialists in his country. For a diplomat he comes near to being undiplomatic. Village and town organization, before and after the Taika reform of 645 A.D.; the Taika reform; clan, family, and slave organization; the significance of Japanese genealogy; poverty, and governmental and religious organizations for the care of the sick and the poor are discussed in Part I. The divisions of lands, taxation, the introduction of money—cloth, rice, and metals—and financial organization are dealt with in Part II. Agriculture, sericulture, industry—fisheries and mining—and commerce, domestic and foreign, are covered in Part III.

A clear, if somewhat mechanical, outline is used by the author: throughout the study the dividing line is the Taika reform; the earlier period of Japanese history—prior to the Great Reform—he designates the High Empire; the later period is spoken of as the Low Empire. The status of various subjects of an economic nature mentioned in the foregoing is traced before and after the Taika reform.

Mr. Yoshitomi has done his work well; his documentation throughout is thorough; his bibliography of twelve pages is satisfactory; his style is simple, clear, and interesting. Happily the author does not limit himself to a history of his own country: his method is comparative so that similarities and dissimilarities in the history and social economic organization of Japan, China, India, Egypt, Greece, Rome, and Western Europe are constantly being pointed out. Perhaps his main thesis is that there is an essential equality among races and cultures; this he maintains strongly. He is an avowed opponent of the school of Chamberlain, Grant, and Stoddard.

H. F. MacNair

University of Chicago

Urbanization: Its Effects on Government and Society. By JOHN GIFFEN THOMPSON. New York: E. P. Dutton & Co., 1927. Pp. xiii+683. Price, $6.00.

Few notions are of longer standing or of greater respectability than that of the thoroughgoing superiority of the country to the city. It has been the basis for religious homilies and statesmanly apprehensions since when the memory of man runneth not to the contrary. And though the notion is anomalous in a time, like our own, when urbanization is becoming the norm the world over, its vitality is nevertheless undimmed. Witness the chorus of apprehension that still arises over the growth of cities and the artificial stimulants applied here and elsewhere to stem the cityward tide. The age-old stereotype, bright with moral pretense, operates, moreover, as a deep-lying inferiority feeling to lessen the pride and patriotism of city-dwellers and to produce in country people a moral complacency immune to self-criticism. Does not the average city-dweller in his prime inflate himself with a secret pride in urban audacity if not wickedness and, in his maturity, harbor a yearning that grows with old age into a nostalgia for that physical seat of all human virtues, the countryside? There is damage to morale in this lurking notion that the city is the place into which fortunate young people go to make their fortunes and out of which fortunate mature people move when they have made their pile. It smacks, however, of the sacrilegious to disturb so sacred a belief; but science is sacrilegious.

In this volume we have from one point of view—explicitly the political, though implicitly the social and economic as well—the denial, yea the refutation, of this ancient prejudice. In successive chapters the city is shown to be, if not the cradle of liberty, the most favorable environment for civil and religious liberty, for freedom of thought, speech, and press. The urban environment is shown to have an appreciable advantage over the rural in respect to the development of political capacity and aptitude, the promotion of political initiative and political creativeness, and in respect to political leadership. Even if political corruption were inherent in city life—which it is not—it is hardly worse than rural lethargy and inefficiency. Efficiency abounds in the city; the health of city dwellers is superior. The lower birth-rate of the cities is not indisputably a disadvantage—I should call it a sure sign of moral intelligence. Nor do morality and religion, in the

unequivocally good senses of those terms, suffer from urban environment.

The debate as to the differential value of urban and rural life is at best partly academic, though in this volume it never sinks to the level of the sophomoric. It is academic, because in part, it depends upon definition of crucial terms. Note my foregoing statement about morality and religion. The best senses of those terms are, of course, the *city senses*. To assume that begs the question in favor of urbanization. But it must be admitted that if question-begging is an essential in polemic discourse, turn about is but fair play. Certainly it is high time for the city-dweller to have his turn at this indoor sport. He is, or is shortly to be, in the majority the world over. Moreover, as regards health, efficiency, and co-operation, the argument sustains itself upon the basis of verifiable fact.

This book is as careful in its methods as the subject allows. It represents primarily a moral rather than a scientific enterprise. It serves a useful purpose; for in presenting the city as "the natural and superior habitat of men living together in political life," it lays the foundation for much-needed political autonomy for urban areas. And in fostering the notion that it is indubitably good for people to dwell together, we take the first step toward making it better.

T. V. SMITH

UNIVERSITY OF CHICAGO

Government Ownership and Operation of Railroads. By WALTER M. W. SPLAWN. New York: Macmillan Co., 1928. Pp. xiv+478.

This book surveys the operation of railroads in different countries to determine the comparative success of public and private operation. The author has a slant toward private ownership, but his historical research is fairly objective. He decides that the historical method is inconclusive, and bases his opinion chiefly on deductive reasoning from the major premises of the classical school. He identifies public operation of utilities with practical politics; and like many contemporary economists in the field of public utilities who seem to be led, as by an invisible hand, into the fertile field of apologetics for privately owned public utilities, he devolves into a debater on the negative of the proposition for public ownership.

From the author's historical material a person with a different bias might make the following generalizations:

1. Historically there is a trend toward government ownership.

2. Government operation is not necessarily practical politics. The railroads may be administered by a new public authority, a board of trustees, non-political, permanent, and self-perpetuating. The merit system may choose public administrators by the same methods by which technicians are chosen by the industrial corporations.

3. It is admitted that autocratic governments like that of imperial Germany, Italy under Mussolini, and the present régime in Russia are successful in the operation of railroads.

4. A good case for successful government operation may be made for representative democracies like Australia and Canada.

5. A case for the success of private ownership can be made chiefly on the assumption that earnings or dividends are of paramount importance over general welfare or social considerations, such as military exigency (Germany and Austria), the speedy settlement of a new territory (Australia and Canada), the desire to develop the industries of a country (Russia), the desire to attract foreign capital (China), the desire to advance wages during periods of inflation (United States during World War and many other examples of public operation). This assumes the valuations and presumptions of the "price" as opposed to the "institutionalist" or the "welfare" economics.

6. Even on the "price" or pecuniary assumption a case could be made for public ownership, because (*a*) private enterprise characteristically seizes the most profitable situations (Canadian Pacific) and leaves the government to provide the service where the topography is more rugged and the traffic less dense; and (*b*) private enterprise does not always earn its profits by risks, since the government has aided private roads by subsidies and guaranties (United States and Canada), and takes over roads when they fail through overcapitalization (Canada) or break down under the strain of price inflation and the exigency of war conditions (United States).

In fact, the reviewer is inclined to believe that the author exhibited some astuteness when he sheered off from historical narrative and adopted the safer method of deduction from stereotypes. At any rate, the author must be given credit for producing a work that can be read with profit by all students of railroad problems.

HARVEY W. PECK

SYRACUSE UNIVERSITY

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